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Tariffs and Wayleaves.

WE venture to think that in refraining from using the Electricity (Supply) Act as a text for his presidential address to the Incorporated Municipal Electrical Association, Mr. R. W. L. Phillips was extremely well advised: the electrical industry has read, said, and heard enough on that subject to last for a long while to come; the working of the Act will, however, provide abundant material for comment and criticism when the machine gets into motion. We would congratulate Mr. Phillips also on his timely reference to the excellent Report of the Advisory Committee on Domestic Supplies of Electricity; as he says, that Report was overshadowed by the Bill, but it is too valuable a document to be pigeonholed, and thanks are due to the president for bringing it into prominence on so appropriate an occasion.

It will be observed that he tacitly accepts the two-part tariff as correct in principle, his comments relating mainly to the method of determining the fixed charge; this has always been a vexed problem in connection with domestic consumers, and as Mr. F. W. Purse recently demonstrated in our columns, it offers difficulties even in the case of bulk supply. The Advisory Committee itself was unable to arrive at a definite conclusion on the subject. We would suggest that so far as domestic electricity supply is concerned, it is undesirable to attempt to make assessments on individual installations; a broader basis should be sought, founded on averages, not on particular instances. Mr. Phillips almost committed himself to this view, hinting that the actual method adopted was immaterial, and that the practice followed in fixing the values of other forms of rating might meet the case sufficiently well. The universal adoption of a uniform principle of assessment, leaving the actual charge to be fixed by each undertaking for itself, would, as he says, be of immense benefit to the whole country. Even now, a large number of undertakings adhere to the flat-rate system, which discourages the development of the use of electricity in the household.

With regard to that other very important question—the cheapening of distribution—Mr. Phillips's comments on the difficulties and abuses of the wayleaves problem are abundantly endorsed by Mr. W. C. Bexon, in

his practical paper on "Distribution over an Extensive Area." Both these gentlemen have acquired extensive experience in the negotiation of wayleaves, and Mr. Bexon in particular is somewhat bitterly eloquent over the obstacles presented not only by landowners and tenants, but also by the too-stringent regulations of the Post Office and the Electricity Commissioners. It is a familiar subject, a grievance of long standing, but practically no progress has yet been made towards facilitating the use of overhead lines in rural areas; we hope that, as the result of the publicity given to it at this Convention, this very urgent question may receive the attention that is its due.

The All-Electric Home Competition.

In this issue we are able to give the results of the competition which formed a part of the recent E.D.A.-E.L.M.A. Campaign. We extend our heartiest congratulations to Miss Gardiner, who headed the list of prize-winners, as well as to the others comprising the list. It is peculiarly appropriate that a lady should secure the first prize, for the Campaign was primarily a ladies' affair, being directed towards the improvement of lighting in the home as a first step to complete domestic electrification.

It is noteworthy that so large a body of people took a practical interest in the Campaign; about 150,000 papers were received. The order of preference of the public for the given attributes of electric lighting should form a useful basis for future publicity.

We think that it can be said that this branch of the Campaign was successful, and there is no doubt of the excellent results obtained from the all-electric demonstration homes which were set up all over the country.

It may be possible in a short time to give some more definite information regarding the effects of the Campaign and the lessons to be learned from it, but in the meantime all concerned can rest assured that the money spent was well spent.

Electricity Used Dangerously.

In a leaderette under this title in our issue of September 19th, 1924 (p. 418), we drew attention to certain conditions under which the use of electricity might be attended with danger to person or property. Referring to the introduction of broadcasting, we said: "the wearer of a headphone which happens to be faulty may, in effect, have an earthplate clamped to his head, or hers, and on picking up an electric kettle or other device which is likewise faulty may have a very unpleasant experience." To avoid such an accident we advised occasional inspection. Unfortunately last week precisely what we had foreshadowed as a possibility was realised in fact; a woman wearing headphones apparently grasped an electric table-lamp fitting which was in a faulty condition, and received a fatal shock. It appears that the headphones, which were connected to a crystal receiving set, were likewise faulty, a not uncommon occurrence, so that the circuit to earth was complete. As we have pointed out, there is in bedrooms as a rule no means of making contact with earth, so that the chance of receiving a shock from a faulty fitting is infinitesimal, but the extension of the wireless circuit with its necessary earth connection changed the conditions.

It will be seen that two faults must occur simultaneously before the risk arises at all; in the present instance one of them was known to exist, for the lamp fitting was out of order and the family of the unfortunate lady, it was reported, "had been anxious about her making use of it." The fitting should certainly have been put out of commission or repaired directly it came under suspicion—and the same applies to all electrical apparatus, whether fixed or portable.

In view of the combination of circumstances necessary to bring about an accident of this kind, we do not regard the risk as one that calls for drastic action; it is no greater than scores of others to which we are constantly exposed in the daily round. But those who care to take precautions can readily insert a transformer between the receiver and the listening circuits, at small cost and without detriment to the reception. It will then be necessary for faults to occur simultaneously in three separate apparatus— a contingency so remote that no one need worry about it.

A South-East Lancashire Scheme.

We have received from the South-East Lancashire Electricity Advisory Board a copy of a document which is of considerable interest from several points of view; a *résumé* of its contents appears elsewhere in this issue. It is described as "indicating a method by which the District could be developed with general advantage, provided the Central Electricity Board could make the necessary arrangements for carrying it into effect," but the authors "expressly refrain from putting forward the scheme as a proposal or recommendation within the meaning of the South-East Lancashire Electricity District Order, 1923," yet it has been "approved by the South-East Lancashire Electricity Advisory Board," on May 24th.

The South-East Lancashire electricity supply authorities are noted for their enterprise and alertness; even before the Government took action in the matter of co-operation, some eleven years ago, they had formed a committee to prepare a scheme of interconnection for Lancashire and Cheshire, and on other occasions they claim to have been first in the field. Last year, when the Electricity Bill was passing through Parliament, a Special Committee of the Advisory Board proposed that the Board should be replaced by a Joint Electricity Authority, with a view to developing the District and securing a lower tariff within that area than the national tariff. The idea was, as we said (October 15th, 1926, p. 606), to secure exemption for the area from the collective operation of the national scheme; but the Board did not actually adopt the proposal. In the present instance, when it "approved" the Committee's scheme, the Board also adopted a resolution agreeing to afford facilities to, and to co-operate with, the Commissioners in the preparation of a scheme for the District by the latter.

Our reading of the circumstances is that the Board, through its Committee, is endeavouring to shape its ends and to lead the Commissioners in the direction in which it would have them go. Up to a point, this is a commendable policy, and it certainly does credit to the shrewdness of the authorities, to which we have already alluded. But, as the Commissioners indicated to a deputation from South-East Lancashire last year, an area under the national scheme may, and probably will, comprise more than one Electricity District—perhaps five or six of them. In the scheme before us we see no evidence at all of any recognition of this fact; the scheme relates almost solely to the one Electricity District, takes no account of interconnection with external areas, and provides no 132,000-V trunk mains. We gather that, as before, South-East Lancashire wishes to be left to work out its own salvation. Technically, we do not criticise that ambition; very probably the residents in the District would be better off if they could gain their end. But the Act has been passed, and *now we must all think nationally*. It is not in the national interest that South-East Lancashire, or any other area, should enjoy a selfish isolation; it has been decreed by Parliament that we must all pull together, even though some Districts gain nothing—or even lose a little—thereby. We think we see in this proposition the parochial policy again, on a larger scale, it is true, but still the same in essence. It will not do: broader views must prevail, and we have no doubt that the Commissioners, when they transmit to the Central Electricity Board a scheme involving S.E. Lancashire, will be found to have gone their own way, and to have dealt with the northern counties as a whole.

Deptford (East) Re-visited.

A brief outline of the extensions of plant carried out during recent years to meet the needs of electric railway traction, in addition to normal industrial load expansion.

THE Deptford (East) electricity generating station, the pioneer high-voltage plant of the world, is a lasting memorial to the directors of the London Electric Supply Corporation, Ltd., to Mr. G. W. Partridge, its managing director and engineer, and to Dr. S. Z. de Ferranti, whose genius gave it birth, always recalling to mind reminiscences of those stirring times of 40 years ago.

The last two original Ferranti generating sets are now being dismantled, and the remaining historic Partridge h.p. switchgear will soon be displaced, for the station now aggregates 100,000 kW, and forms one of the permanent centres of the production of electricity for the London area.

Since the station was last visited in 1919,* besides the normal growth of industrial load, it has added to its list of consumers the whole of the electrified South-Eastern section of the Southern Railway, together with considerable additions on the L.B. & S.C. section, the curves reproduced in fig. 2 indicating more eloquently than words the growth in output of the station, due largely to what is one of the most important railway electrification schemes so far carried out in Europe. The old reciprocating engines, some of which did duty for over 30 years, had of necessity to be scrapped, and the engine room which formerly housed 16,000 kW of plant is to-day occupied by turbo-generators which are capable of a combined output of nearly 10 times that capacity; a view of one bay of the engine room as now constituted is shown in fig. 1, in which eight turbines are installed, the other bay being similar.

The extension of the single-phase lighting system has been met by installing three 4,000-kVA and one 7,500-kVA turbo-alternators, generating at 2,500 volts, which pressure is stepped up by means of transformers to 10,000 volts. To meet the increase in the single-phase railway load and the growth of the industrial supply one 8,750-kW and one 15,000-kW three-phase turbo-alternators generating at 6,600 volts have been installed, while to supply the South-Eastern section of the Southern Railway, three 20,000-kW turbo-alternators generating at 11,000 volts have been installed, and a further 25,000-kW three-phase turbo-alternator for the latter purpose is to be built.

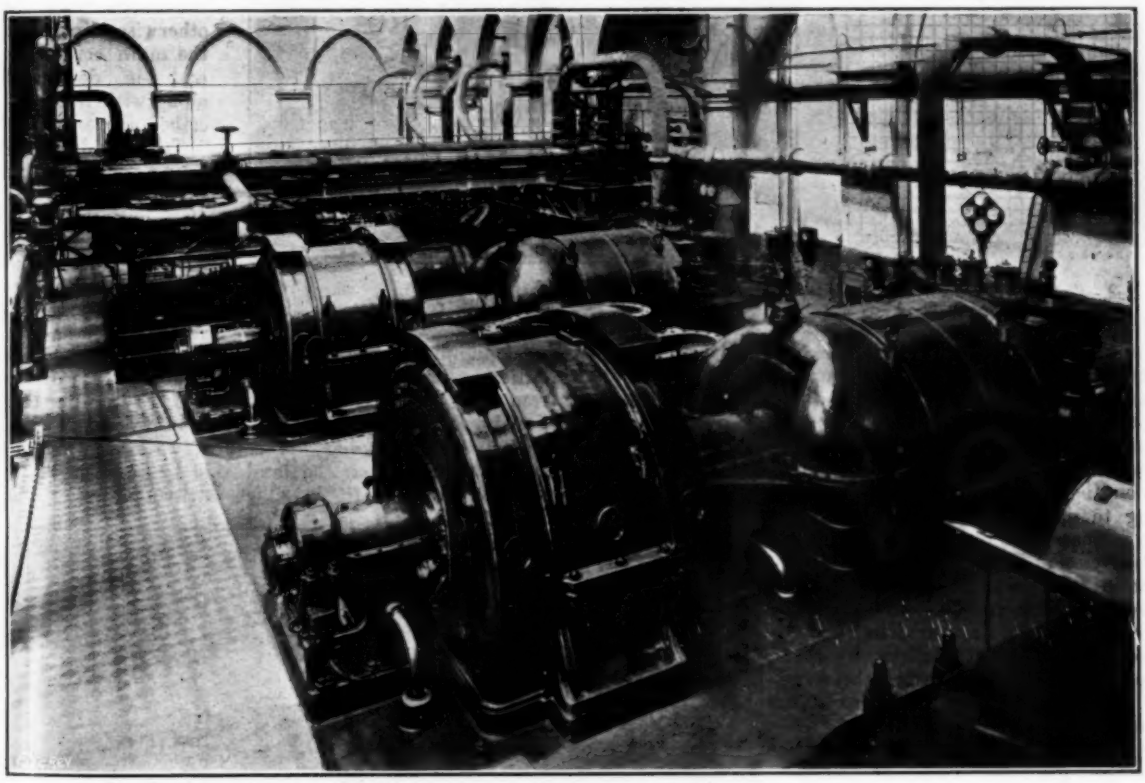


Fig. 1.—Part of the Turbo-generator Room at Deptford (East) Power Station.

With the exception of the machines which serve the lighting system proper, all the generators have been wound for three-phase working, but so built and arranged that any one set can supply the single-phase railway system. The turbines are all supplied with steam at 300 lb. per sq. in. pressure at 700 deg. F., and are bled at two stages: one high-pressure stage for water evaporators, of which one is connected to each main unit, and the low-pressure stage for working in connection with water de-aerators, one of which is used with each turbine for removing all oxygen from the condensate before it is pumped into the boilers through a closed-feed system.

* See ELEC. REV., August 9th, 1912, and July 11th, 1919.

When these extensions were commenced four or five years ago, no complete closed feed system was in existence, and the Deptford staff had to evolve a system which has proved its efficacy by limiting the oxygen content to an average of 0.05 c.c. and under. The condensate, after being removed from the condenser by the extraction pumps, is pumped through a de-aerator heater of the surface flash type wherein all air is removed by a connection to the main condenser from the water side, while at the same time the temperature is raised by means of the steam bled from the low-pressure stage of the turbine, the action being practically automatic, a constant temperature being maintained at all loads and the vacuum in the water space of the de-aerator corresponding to the temperature. The flow of water passing to the de-aerator is controlled by a float valve in the lower part of the vessel; a second, or booster, pump extracts the condensate from the de-aerator and delivers it under pressure to the suction side of the feed pumps that deliver to the boilers *via* high-pressure heaters which raise its temperature to 220 deg. F.

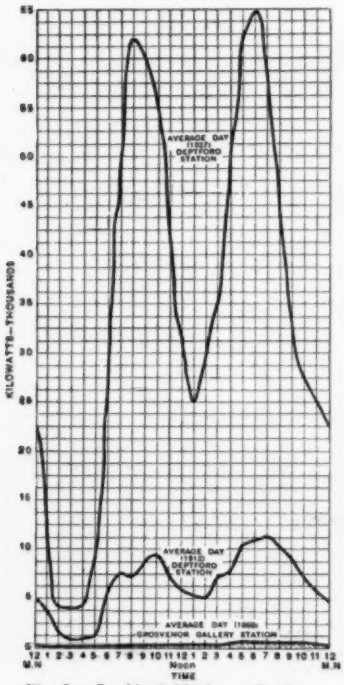


Fig. 2.—Combined Maximum Loads on Generating Station.

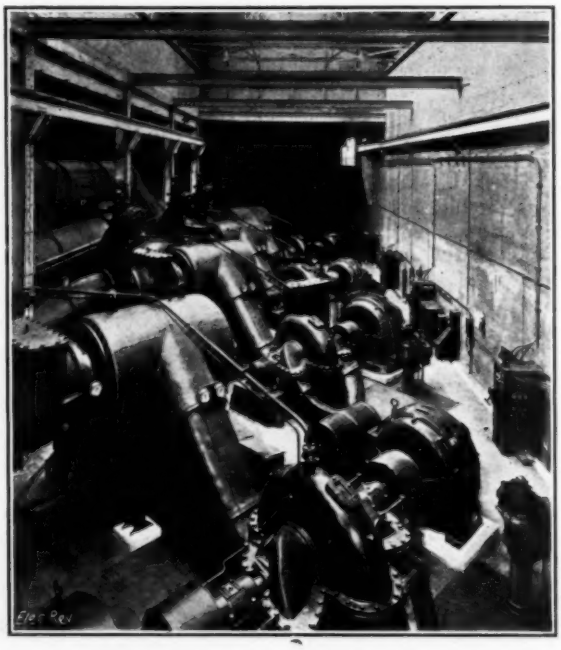


Fig. 3.—New Condenser Water Pump House.

An open surge tank is connected between the main condenser extraction pump and the de-aerator booster pump, into which any surplus condensate is discharged by the condenser extraction pump during such times as the boiler feed pumps do not require it; should the demand by the feed pumps be greater than can be satisfied by the main plant, then the pressure fall on the discharge side of the extraction pumps will allow the stored water in the surge tank to discharge into the de-aerator. An unusual feature is a connection between the surge tank and the suction eye of the feed pump, called the pressure head line, in which a non-return valve is inserted; normally, so long as the booster pump is working, this valve is kept closed by the discharge pressure of the booster pump, thus preventing the latter discharging to the surge tank; if however, the booster pump should fail, thus starving the feed pumps, the pressure head line will immediately come into action, due to the pressure on the bottom of the non-return valve being relieved, allowing the surge tank to discharge direct to the feed pumps, the tank being placed at a height above the feed pumps to ensure sufficient head on the suction side.

Each main turbine is provided with extraction and booster pumps in duplicate, one being steam driven and the other motor driven. Make-up water for the boilers is obtained from the town's mains, and is either treated in lime-soda plant, or passed through evaporators. The water, which is chemically softened, passes through an independent de-aerator before going to the boilers; that from the evaporators is either discharged to the surge tank, or otherwise mixed with the main condensate and is de-aerated along with it as described above.

To provide circulating water for the surface condensers, an entirely new pump house (fig. 3) was constructed and equipped with five motor-driven centrifugal pumps, each having a normal capacity of 1½ million gallons of water per hour. The water is drawn from the River Thames through a 10-ft. diameter tunnel, which is divided on its horizontal centre line, the top part forming the return, while the bottom suction part ends on the land side in an open 20-ft. diameter sump shaft, in which settles the larger and heavier *débris*, which is removed at intervals by grabbing; from the land shaft a 10-ft. diameter tunnel passes under the floor of the pump house to the suction side of the pumps. There are also removable screens in the land shaft which prevent floating material passing through, and for removing leaves and similar material each pump is provided with a "Deptford"

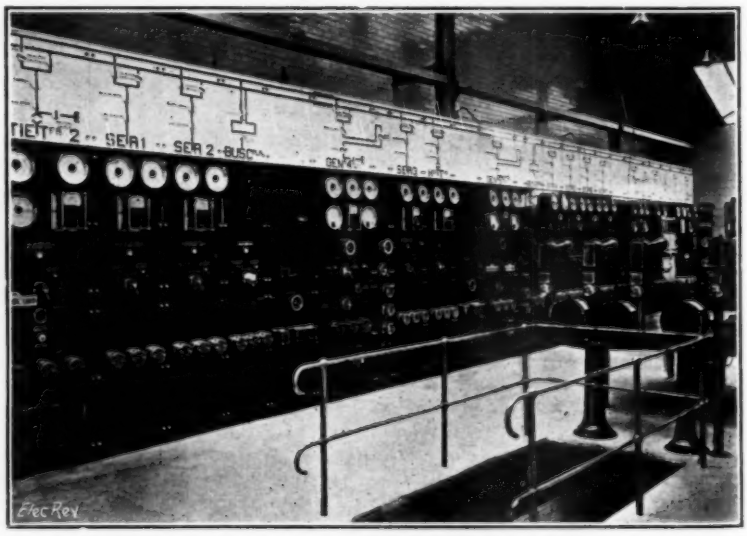


Fig. 4.—Control Room, showing 11,000-V Board.

rotary strainer on the discharge side, visible in fig. 3, after passing through which the water is discharged into two 48-in. diameter cast-iron pipes which carry it to the condensers, whence it returns through two similar pipes that converge a little beyond the land shaft into the top part of the tunnel leading back to the river; the system works on the siphon principle, and all valves on the pumps and condensers are so far as is possible electrically operated.

The cooling air for the main generators is circulated on the closed system, each having its own cooler, water for which is obtained from the circulating-water mains. Temperature-indicating and alarm devices are fitted.

The recent switch-house extension is a brick building 104 ft. long by 52 ft. wide, adjacent to the turbine room. The gear consists of 27 oil switches arranged on the top floor; on the floor below are the duplicate bus-bars, whilst on the same floor as the switches, but separated from it by a brick wall, is the main control room (fig. 4), which overlooks the turbine room. Of the cellular construction, each oil switch has a rupturing capacity of 750,000 kVA. Both the extensions on the 6,600-volt and the 11,000-volt systems are housed in this building, and to admit of both systems being connected together to suit the running conditions of the station, two 7,500-kVA banks of single-phase transformers fitted with tertiary windings have been connected in star-star; means are also provided whereby the forced oil-cooled transformers can be switched on to the single-phase railway bars to enable a supply to be given from the 11,000-volt generators, two phases of the three-phase windings being used for this purpose.

The control wiring is arranged so that it is impossible to open any main oil switch until the isolator is in the full "off" position, which avoids the danger of mistakes being made, and the main generators are protected by means of two oil switches in series, one directly against the bus-bar, whilst the other is placed by the machine, one of them being arranged for balanced protection and the other for overload only. The method of mounting the current transformers which operate the relays is to slip them over the lead covering of the cables, and they are as far away from the high-voltage gear as it has been possible to place them, so that any fault developing on the bus-bars, &c., will not involve the apparatus on which the clearing of the circuit depends. For the same reason, the control cables follow different routes to the main cables, and where they pass into the bus-bar cell structure.

The capacity of the station when the 6,600-volt and 11,000-volt three-phase systems are tied together by means of transformers has necessitated the installation of reactor coils in circuit with the transformers, and also with several of the feeders which serve the adjacent sub-station, to lessen the shock to the system in the event of a fault occurring. Some of the features of the special arrangement of the switchgear to meet the needs of the Southern Railway electrification scheme have already been dealt with.*

A complete new boiler house has been erected (fig. 5), each of the 14 boilers installed having a normal actual evaporation of 50,000 lb. of water per hour, and an overload rating of 65,000 lb. per hour, at 325 lb. pressure and a total temperature of 725 deg. F. A further 6 units are now in course of erection, each having a normal evaporation of 64,000 lb. per hour, and an overload rating of 80,000 lb. per hour. Each is fitted with a steel-tube economiser and an air heater (the gases being discharged from the stack at a temperature not exceeding 230 deg. F.), and two travelling grates, each 8 ft. 6 in. wide, of the compartment type arranged for balanced draught. Two coal shoots are fitted to each boiler to enable two different types of coal to be burnt on the "sandwich" system; each boiler is equipped with its own forced- and induced-draught fans, directly coupled to d.c. variable-speed motors, while a complete outfit of measuring instruments has been installed for each unit, there being an operating combustion engineer on duty during each shift. The seven feed pumps are all turbine driven, varying in capacity from 11,000 to 35,000 gallons per hour, the exhaust steam from them being discharged into the high-pressure feed heaters.

The ashes are discharged through a closed shoot from the hoppers into a concrete trough in the basement floor,

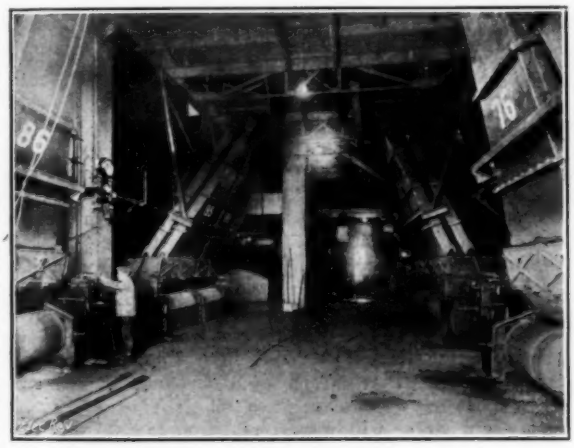


Fig. 5.—New Boiler House.

Fig. 6.—Ash Conveyor, Water-trough System.

and transported by means of a water sluice a distance of 350 ft. to a sump at the wharf front, where they can be handled by a grab crane, to be loaded into barge or wagon as required. The water is circulated by motor-driven centrifugal pumps in a pump house on the wharf front adjacent to the sump, the pumps drawing their water from the ash sump through a metal screen; a view of the sluice is shown in fig. 6.

The removal of the riddlings from the hoppers under the grates is by means of a system of ducts laid in the basement floor, whence they are blown by air to the top of the bunkers, at a height of 100 ft., where they mix with the fresh coal.

Coaling is done by two electric grab cranes of the horizontal luffing type on the wharf, which deliver into a hopper, whence the fuel is raised 90 ft. by a telpher and delivered to the bunkers, or deposited on the coal store as required, weighing being done by a track weigher, the rate of unloading being 150 tons per hour.

In conclusion, it may be remarked that work has already commenced on the adjacent site of the new Deptford (West) generating station, the contract for which was recently placed with Sir Wm. Arrol & Co., Ltd., by the London Power Co., which will in due course take over the Deptford (East) station, leaving the London Electric Supply Corporation, Ltd., to fulfil the functions of a distributor.

We are indebted to the company for the particulars and illustrations reproduced above.

* See ELECTRICAL REVIEW, September 6th, 1926.

Single-Phase Induction Motor Starting Devices.

A brief review of the methods employed for starting single-phase induction machines, and a description of the Ferraris-Arno method.

By G. WINDRED.

THE problem of obtaining an appreciable torque from the single-phase induction motor during the starting period is one which has occupied the attention of designers of these machines for a number of years, in fact, since the introduction of the machine, and the number of devices evolved during this period is an indication of the extensive use of this type of motor.

This does not agree with the generally accepted impression that the single-phase motor has long since become of small importance, but it is not proposed to enter here into a discussion of this point.

The object of the present article is to discuss the relative merits and otherwise of the known forms of starting device, and to describe briefly a starting arrangement giving greatly superior characteristics to any of those at present in use. It should be mentioned that the device in question was evolved in connection with traction work, for which the advantages of using only a single line for the supply of power need no elaboration.

For the purpose of comparison it will be advisable to briefly review the subject of starting single-phase induction motors, and to describe some of the better-known methods of starting and their characteristics.

Torque of Single-phase Induction Motor.

In the first place, it is instructive to examine the conditions existing in the single-phase machine at standstill and during the accelerating period up to full speed, when the machine behaves in a similar manner to a shunt d.c. motor, and is quite satisfactory for ordinary service.

It is comparatively easy to show* that no torque is produced in the rotor of an induction machine excited only in one axis by a pure alternating wave of flux, these conditions being analogous to those existing in a standard single-phase machine with only one stator winding. To produce torque in the rotor, it is necessary, of course, that an e.m.f. be produced in the rotor conductors, and for this purpose it is necessary that a rotating stator flux shall exist. The only practical means by which a rotating flux can be produced in the single-phase machine consists of the provision of an auxiliary winding on the stator, displaced mechanically usually by about 90 deg. from the main or running winding. If the two circuits comprising this stator system are excited from the single-phase supply, the stator field which results is, of course, the resultant of the addition of two approximate sign waves stationary in space and displaced in phase from each other. This resultant is a pure rotating wave of flux of approximately sine formation, its actual shape and magnitude being dependent upon the displacement of the component fluxes. In order to secure the necessary space-phase displacement of these two fluxes, it is usual to employ resistance and reactance external to the motor windings. By this means it is possible to arrange the required phase displacement experimentally and standardise for the particular type of machine concerned.†

When the rotor has attained its maximum speed under the action of this rotating field, the currents produced by self-induction in the rotor give rise to a magnetic flux which is carried out of phase with the flux producing it by the rotation of the rotor. This flux may be considered to exist under the same conditions as that produced by the auxiliary or starting winding, which may therefore now be disconnected, the rotor continuing to run under the action of a rotating field, which is the resultant of the flux produced by the main or running winding, and the flux produced by the rotor conductors themselves and carried into space phase by the rotation of the rotor.

The actual methods employed in practice for the production of an auxiliary flux are of considerable number, each being usually adaptable to a certain form of operation or for certain starting conditions.

In the case of fractional horse-power motors, such as are sometimes employed for the operation of fans, &c., the "shading coil" method of starting gives quite satisfactory results. In this method a portion of the active stator iron is enclosed in a copper coil, which may be either in the form of a few turns of comparatively heavy gauge wire or a single ring of copper. Only one stator winding in addition to the "shading coils" is provided, and the flux produced by this winding induces in the portion of the stator iron enclosed in the "shading coil" a flux which has a different space-phase owing to the different circuit constants of the magnetic system in which it is induced. Under these conditions, the resultant field approximates to a rotating sine wave, and a torque is produced in the manner already discussed above.

The limitations of the "shading coil" method of starting are at once obvious. It is impossible to obtain any appreciable starting torque with the arrangement owing to the necessarily small pole area enclosed by the "shading coil," while the starting and operating efficiency are low on account of the additional losses introduced by the "shading coil," which must remain in circuit all the time the machine is running. For these reasons the sphere of use of this device is limited to machines of very low output, where only a small starting torque is required and the operating efficiency is not of great importance.

A development of the "shading-coil" device has found some practical application in the case of small motors. In this method of starting the shading winding, of heavy gauge wire, is distributed on the stator iron in the form of a second stator winding. For starting, current is switched on to the main or running winding, while the ends of the shading winding, which are brought out to terminals for the purpose, are short-circuited, either directly or through resistance or inductance. The motor now behaves in a similar

* *World Power*, October, 1926.

† See article on "Single-Phase Induction Motor and the Starting Problem," by T. W. Davies, ELECTRICAL REVIEW, January 4th, 1924.

manner to the "shading-coil" machine, except that in the present case the auxiliary or starting flux is produced by a distributed winding, and the field form is accordingly better. When the rotor attains its maximum speed, the shading winding is open-circuited, and the losses incurred in this winding are therefore eliminated while the motor is running.

The starting torque obtainable with this device is appreciable, but on account of the very low starting efficiency, it is not suitable for machines other than those of low output, of the order of about 1 h.p.

Perhaps the most frequently used method of starting in practice is the "split-phase" method, about which much has been written, so that it is unnecessary to dwell at great length on its characteristics here.‡ In this system the stator carries a starting winding of smaller gauge wire than the running winding. For starting, the two windings are connected either in series or parallel, and a suitable arrangement of inductance and resistance is employed in these circuits to produce the required phase displacement of the respective fluxes. When full speed is reached, the starting winding is disconnected from the mains, and the resistance or inductance withdrawn from the running winding circuit, the running winding being then connected directly to the mains.

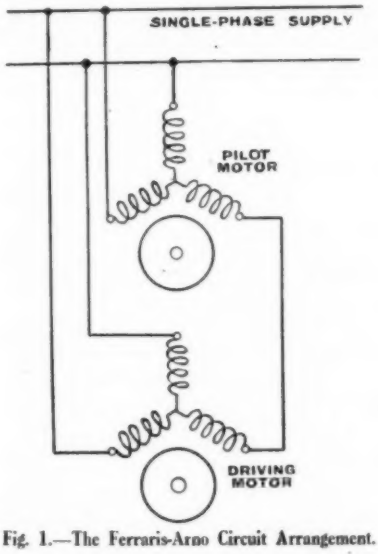


Fig. 1.—The Ferraris-Arno Circuit Arrangement.

The starting torque usually obtained with the split-phase method is of the order of 25 per cent. of the full-load value, with about twice the full-load current in the case of squirrel-cage machines, and about 50 per cent. of full-load torque on a twice full-load current in the case of slip-ring machines.

For small machines having rotors of small kinetic energy, and in cases where a starting current of from five to six times the full-load value is permissible, full-load torque at starting may be obtained by switching the motor direct on to the line. In this case the phase displacement of the motor fluxes is obtained by means of an inherently high-resistance starting winding.

It is seen, therefore, that this method of operation has sufficiently good characteristics to warrant its adoption in a number of cases where the required starting currents are permissible and the starting torques sufficiently high.

There are numerous practical cases, however, where the split-phase method of starting cannot conveniently be employed on account of the low starting torque corresponding to a reasonable starting current. In such cases it is usual to employ some form of single-phase commutator motor.

The commutator motor, however, for alternating current has not found the sphere of use in this country which its reputed features appear to warrant; while it is true that this state of affairs is largely due to engineers in general being loth to install a not thoroughly tried design, it cannot be overlooked that the existence of a commutator, particularly on an a.c. machine, presents practical difficulties.

‡ A recent paper on "The Starting of Single-Phase Induction Motors," by F. A. Lauper. *Journal* I.E.E., Vol. 65, No. 361, January, 1927, treats the subject exhaustively.

Operation by Ferraris-Arno Method.

The method of operation about to be described is entirely different from the majority in general use, and although practical examples of its application are comparatively few, if at all existent in this country, its operating characteristics are very much better than those of any of the better known methods. In this case also the small sphere of practical use may be attributed to the fact that the device has not been tried out to any extent in this country, so that consequently, as no test records and comparatively little descriptive matter are available, the reason for such a restricted sphere of use is apparent. In the Ferraris-Aruo system the main or driving motor is usually a three-phase machine, which may be of perfectly standard construction. Two of the stator terminals of this machine are connected to the single-phase mains, while the third terminal is connected to one of the terminals of a three-phase pilot motor whose remaining two terminals also connect to the single-phase mains. This circuit arrangement is shown in fig. 1. Means must be provided for starting the pilot motor from the single-phase mains, and this may be conveniently accomplished by some form of monocyclic device§, or alternatively by a commutator type auxiliary motor. The former method is, of course, preferable from the practical point of view.

When the pilot motor is running, the two stator phases connected to the single-phase supply provide the stator flux which, combining with the quadrature flux produced in the motor, as previously explained, gives rise to a rotating field analogous to that of an ordinary polyphase machine.

Under these conditions of operation an e.m.f. is induced in the idle phase of the pilot motor. This e.m.f. is in quadrature with the single-phase line e.m.f. owing to the fact that it is produced through the medium of the rotor system which, at synchronous, imparts a 90 deg. (electrical) displacement to the e.m.f. induced in the idle phase.

The quadrature e.m.f. is a power e.m.f. capable of producing the necessary flux in the third phase of the driving motor to render this machine self-starting, since under these conditions it is supplied with an unbalanced system of e.m.f.'s which give rise to a rotating flux in the stator winding, producing conditions analogous to those existing in a polyphase motor under normal operation.

The starting arrangements necessary for the driving motor in this system of operation are very simple, and may take the form of either a triple-pole switch or a plain star-delta starter for connecting the driving motor to its polyphase system of e.m.f.'s.

The starting torque obtainable with the arrangement is very much larger than in the case of an ordinary split-phase motor, and as an example, the following test is of interest:—

A 5-h.p. three-phase squirrel-cage motor was used as a pilot motor, being connected by two of its stator terminals to the single-phase supply. The idle phase of this machine was connected to one phase of a 35-h.p. squirrel-cage motor, the remaining two phases of which were connected to the single-phase supply.

The starting torque was measured by a spring balance, and with the stator winding star connected, normal connection being mesh, a torque of 26 per cent. of full-load torque was measured.

This figure is approximately half the torque which would have been developed by the driving motor on a direct three-phase system, and could, of course, have been increased by using a larger pilot motor.

The current taken from the line during the test was

§ *Ibid.*

slightly in excess of the full-load value, and the current from the pilot motor was half this value.

In the case of ordinary split-phase motors of the squirrel-cage type, 25 per cent. of full-load torque at starting, with a current of about twice the full-load value, are average figures, from which the advantages of the pilot motor method are very obvious.

As a further example of the operating characteristics of the pilot motor method of operation, practical instances of its application to heavy duty work might be cited. The method has given satisfactory service in its application to the main drive of cranes and similar heavy-duty apparatus, and in view of this fact it is difficult to decide on the reason for its very small sphere of use in this country.

Several examples of the application of the method, with slight modifications, to traction work occur in America, where the Norfolk and Virginian Railways employ main-line locomotives working on this system with quite satisfactory results.

In view of the foregoing remarks, it is evident that the arrangement has not obtained the sphere of use in this country which its superior characteristics warrant, and it is with the object of bringing the arrangement to the notice of the engineers concerned that the present article has been written, giving, in the author's belief, a description of the method and its application hitherto unpublished in this country.

In conclusion, the writer wishes to record his thanks to the General Electric Co., Ltd., for the test figures and much of the information contained in the foregoing.

A Radio-Telephone Loud-Speaker.

So much interest has been evinced in the different types of large-diaphragm and hornless loud-speaker at present in use that a suggested new form of diaphragm, together with some details of the method of its construction, will be welcomed by user and manufacturer alike.

By ERNEST W. BRAENDLE, A.M.I.E.E.

THE broadcast radio-telephone loud-speaker of the present day is rarely, if ever, to blame for the appalling noises so often presented to the unfortunate listener as "broadcast reception." Horns and other parts may be, and often are, the cause of a "hard" or "soft" quality being imparted to the sounds emitted, according to whether the upper or lower register is accentuated, but they do not account for unmusical noises. By far the worst offender in the production of these sounds is the receiving set's last stage of amplification, usually so inadequately designed to deal with the power its owner would like to get out of it. However, it is not intended to dissertate on the causes of distortion in amplifiers, but to present to those who have already mastered the subject the means whereby they may reap even more enjoyment, both for themselves and others, by the production of even better results.

Let us then assume that satisfactory amplification has been obtained, and that therefore all we require is to deal with the finer points, such as "timbre," "balance," and the "final result": by "timbre" we mean the quality of a sound, as compared to the original; since this depends on the correct reproduction not only of the initial note itself, but also of all the harmonics and overtones of which the sound is built up, it is essential that correct "balance" over the whole audible scale be obtained. The "final result" is attained mainly by utilising a loud-speaking device suited to the acoustic properties of the room in which it is placed. Of one thing readers may be assured, and that is the fact that the average transmission from the London (2 LO) broadcasting station, although not perfect, is extremely good, and fully warrants a much wanted improvement in the many minor considerations of reception.

In a search for these qualities, early experiments quickly eliminated the "horn" loud-speaker as never having satisfactory acoustic qualities without being both cumbersome and expensive. The "rigid cone" construction of paper diaphragm gave very good results, but, owing apparently to the large area over which "buckling" can take place, almost perfectly geometrical construction is necessary before it can be subjected to any great volume of sound. Another fault is that, although sufficiently "rigid," the cone lacks the "mobility" of its radially-pleated brother, which in turns lacks "rigidity." How then combine these two qualities? At first a "radially-pleated cone" was tried, but again, although sufficiently "mobile" and "rigid," it required too great care in construction to make it popular. The type at present in use consists virtually of a "cone" folded in upon itself, or a diaphragm pleated circumferentially (*i.e.*, in circles about the centre); it has given such satisfaction as to warrant its recommendation, despite the fact that

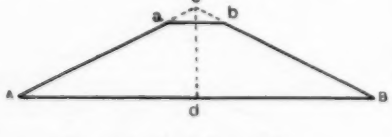


Fig. 1.—Sectional View of Cone.

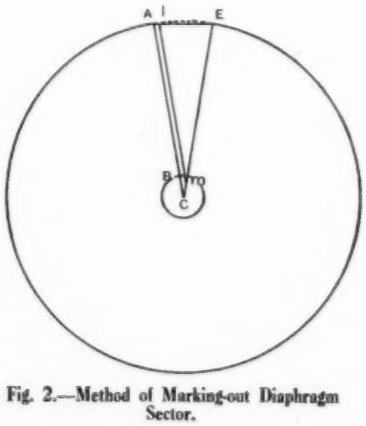


Fig. 2.—Method of Marking-out Diaphragm Sector.

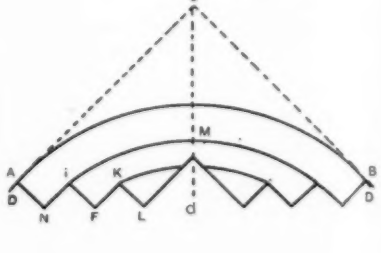


Fig. 3.—Sectional View of Pleated Diaphragm, Dotted Lines Represent Equivalent Cone.

rather more work is entailed in its construction than in the case of the simple cone.

Since, in the final design, the pleated-paper diaphragm is backed by a cardboard cone, wherein is mounted the driving mechanism; and since it is advisable to understand the construction of a cone first before going on to the pleated diaphragm, a short description of cone design is as follows:—Fig. 1 represents a sectional view of a cone, wherein AB is the folded diameter, *cd* the height, and AC or BC the initial radius.

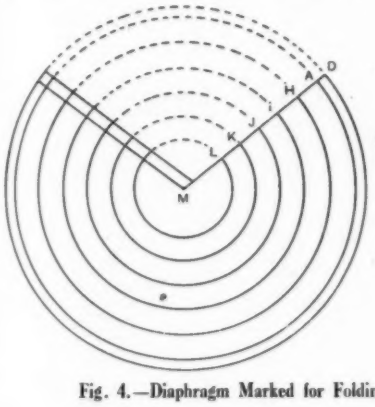


Fig. 4.—Diaphragm Marked for Folding.

To construct the cone, take a sufficiently large piece of paper (or cardboard) and describe a circle of radius equal to AC, which is given by the formula:—AC or BC $= \sqrt{(Ad)^2 \times (cd)^2}$ or AC or BC $=$ cosec $(\frac{1}{2} \wedge ACB) \times Ad$.

Next mark out a sector as in ACE (fig. 2), the arc AE being given by AE (fig. 2) $= 2\pi AC - \pi AB$ (fig. 1); or, since the angle of the sector to be removed is in the same proportion to the complete circle (*i.e.*, 360 deg.) as the length of the ARC removed is to the circumference, then $AE/2\pi AC$ (fig. 2) $= \wedge ACE/360°$ (fig. 2), or $\wedge ACE$ (fig. 2) $= 360 \times AE/2\pi AC$ (fig. 1). Cut out the circle and remove the sector carefully, leaving a lip *lm* about $\frac{1}{4}$ in. wide for fixing; fold until the edge EC lies flat along AC, and glue firmly in place, thus forming a complete cone. Since, for the purpose of supporting the driving mechanism, it is necessary to remove the apex of the cone, thus leaving a hole of the diameter required, a circle with radius CB (fig. 2) is drawn before folding, and the resulting disk removed: the radius CB is given by CB (fig. 2) $= \frac{1}{2}$ (*a b*) $\times$ cosec $(\frac{1}{2} \wedge ACB)$ (fig. 1), where *a b* (fig. 1) represents the diameter of the movement to be inserted.

As previously stated, the circumferentially-pleated diaphragm is, in reality, nothing more than an ordinary cone folded back upon itself several times; some idea of it is obtained from fig. 3, which is a sectional view of the pleated diaphragm, the dotted lines representing the equivalent cone. From this figure it will be seen that the outer radius is still the same as for the cone, and is therefore found in the same way, but several other radii are now required to form the pleats at H, I, J, K and L. It was found convenient in practice to make the central apex M rather higher than the surrounding points A, I, K, and to decide first upon the height M*d* of the central cone and then upon the number of pleats to be formed. Fig. 4 shows a sheet of paper marked out with the various circles ML, MK, MJ, MI, MH, MA (MD is added as a fixing lip, the use of which will be explained later), which, when folded, will form the apexes M, L, K, J, I, H, A (fig. 3), there being two radii for each complete fold.

It has been pointed out that the radius MA (fig. 4) is equal to CA (fig. 3); hence, since the radius ML (fig. 4) is to CA (fig. 3) as the height *cd* is to M*d*, then ML $=$ M*d* $\times$ CA/*cd*. Now H, I, J, K (fig. 4) are equal folds over the distance AL, and therefore this distance divided by five will give the remaining radii, the radius MD being $\frac{1}{2}$ in. longer than MA.

Draw the sector as for the cone, leaving the necessary fixing lip, and cut out; take a hard smooth-pointed pencil or stylus and go over each of the circles, pressing heavily, in order to bruise the paper along the lines, thus enabling the folding to be more easily dealt with. The actual manner of folding is a knack, and beyond pointing out that it is advisable to first lightly bend the folds in the directions required, helping them by lightly pinching them with the fingers, little more can be said to help the reader further; it will also be advisable to keep it on a clear flat surface whilst fixing.

There can be little use in attempting to describe the innumerable methods whereby the electrical mechanism may be attached to the diaphragm, nor is it necessary to discuss the different types of such mechanism at present on the market; therefore, only the particular method of mounting employed by the author in the final design will be described.

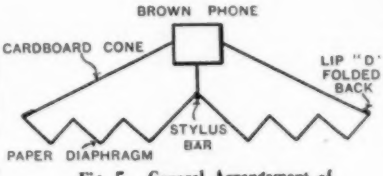


Fig. 5.—General Arrangement of Mechanism

The driving mechanism employed was a Brown A-type 'phone, with both diaphragm and anvil removed, mounted at the apex of a cardboard cone, on whose perimeter was mounted the pleated-paper diaphragm, the centre of the diaphragm being connected to the centre of the Brown reed by means of a metal stylus bar; some idea of the general arrangement may be obtained from fig. 5.

First make both cone and diaphragm separately, taking care that the folded diameter AB (fig. 1) of the cone is the same as the folded diameter AB (fig. 2) of the diaphragm. Drill out the centre hole of the ebonite ear-cap of the Brown 'phone to permit the free passage of the stylus bar, and insert the cap alone in the hole *a b* (fig. 1) of the cone; then fix in place with seccotine (thin carpenter's glue was used for all other fixings). Now fix the cone to the diaphragm in the manner suggested by the dotted lines in fig. 3, and allow the whole to set properly; the lip DD (fig. 3) is next slit radially about every half inch all the way round, an old safety-razor blade being employed, and the resultant pieces are

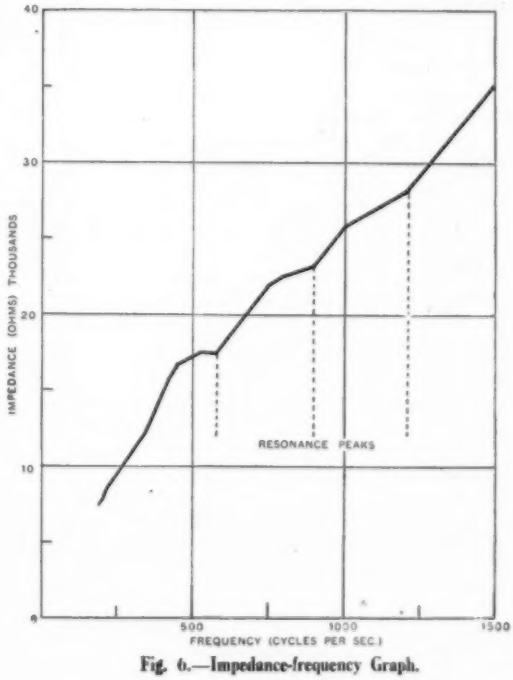


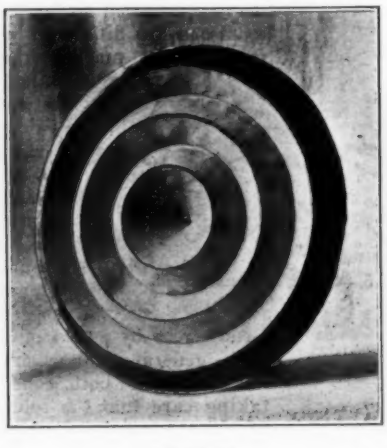
Fig. 6.—Impedance-frequency Graph.

folded back over the cone and glued in place, thus making a firm airtight joint between the supporting cone and diaphragm. A piece of 18-gauge brass, or steel, wire is used for the stylus bar, which is fixed to the centre of the diaphragm by a small drop of glue, the other end of the stylus being held central in the ear-cap by pushing it through the centre of the now useless Brown diaphragm, which is temporarily inserted in the ear-cap for that purpose. Leave the whole for at least 24 hours to thoroughly set, then

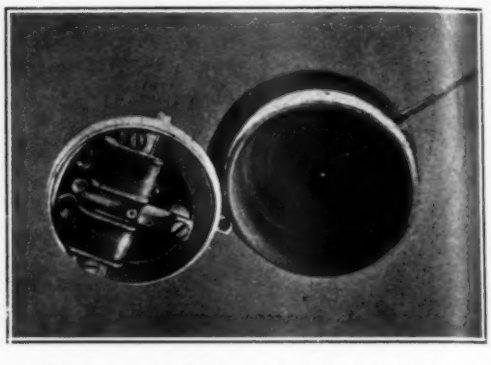
remove the Brown diaphragm and screw in the movement until satisfactory contact is made between the stylus bar and the reed.

The loud-speaker is now ready for mounting and decorating in any manner desired, and if carefully made in the first place should amply repay the trouble expended on it. As regards suitable coatings both for decoration and preservation, the use of waterproof Indian ink decorated with gold or silver, or light transparent water-colours covered with a thin clear varnish, have proved quite successful.

Side view.



Front view.



Back view with mechanism removed, showing stylus bar.

Figs. 7, 8, and 9.—Braendle Pleated-cone Loud-speaker.

For the benefit of those who just wish to make one of these loud-speakers for themselves, without bothering about the methods employed to obtain the necessary measurements, those measurements required for the construction of a diaphragm and cone of 14 inches diameter are given in Tables I and II.*

Great care should be taken both in keeping carefully to these dimensions and in folding, since quite small errors will result not only in a poor finish, but in a quite unnecessary amount of trouble when fitting the cone and diaphragm together.

As regards the results obtainable with this form of loud-speaker, of the dimensions given, tests have shown that although sufficiently sensitive to compare very favourably with any first-class loud-speaker on the market, it is yet capable of handling sufficient volume to permit its use in a small hall without any deleterious effect. There is no "horn" effect and little or no directional quality, the sound in the room appearing to be quite general. One peculiar effect is that the intensity of sound, at the loud-speaker itself, appears weaker than when listened to some distance away; and it has been found beneficial to listen in the next room to that in which the loud-speaker is situated, not because of excessive intensity, but for the reason of obtaining both an acoustic blending and a psychological effect which go far in obtaining that "final result" mentioned earlier.

It is capable of reproducing a far greater range of audible frequencies with exceptionally good balance from top to bottom than any other type yet tried, and it is hoped that those readers who elect to try this form of loud-speaker for themselves will be as fortunate in their results as have been the author and those who have been kind enough to build models to his final design.

TABLE I.—DIMENSIONS OF CARDBOARD CONE.

Initial radius (AC fig. 1) = 7.725 inches.
Folded radius (*Ad* fig. 1) = 7.0 inches.
Initial radius (CB fig. 2) = 1.103 inches.
Folded radius = 1.0 inches.
Angle CAD radius (fig. 1) = 25° inches.
Angle of sector to be removed (ACE, fig. 2) = 33.7 deg.

TABLE II.—DIMENSIONS OF PLEATED PAPER DIAPHRAGM.

Initial radius (MA, fig. 4) = 9.9 inches.
Initial radius (MH, fig. 4) = 8.49 inches.
Initial radius (MI, fig. 4) = 7.075 inches.
Initial radius (MJ, fig. 4) = 5.66 inches.
Initial radius (MK, fig. 4) = 4.245 inches.
Initial radius (ML, fig. 4) = 2.83 inches.
Angle of sector to be removed = 105.5 deg.

In conclusion, the author acknowledges his indebtedness to Messrs. Alfred Graham & Co. for the accompanying "graph" (fig. 6), and to others for their helpful suggestions.

* These are the dimensions of the loud-speaker shown in the accompanying illustrations, which is of a size suitable for indoor and outdoor use.

Electrical Manufacturing in Russia.

Alleged faulty construction of machines.

DESPITE the development of the electrical manufacturing industry in Russia during the past two or three years, as has been recorded in this journal at different times on the basis of information published in the Soviet newspapers, and as set forth by the reports of the growing value of the production year by year, the question has arisen whether or not this expansion has been accompanied by efficiency and the construction of reliable machines and plant. Many complaints have been made in the course of recent months concerning the shortage of certain inland raw and semi-finished materials on the one hand, while on the other, complaints have been expressed by customers respecting defects in machines and accessories supplied by the trusts. But it is only now that a collection of allegations has been published with regard to defective work and delays in the execution of orders, the information appearing in the *Ekon. Sjisn*, of Moscow, dated May 18th, and referring solely to the work carried out or intended to be executed by the "G.E.T." or State Electrical Trust, which now controls the whole of the heavy engineering branch. As the information throws

some light on the internal situation of this important branch, a few extracts from the newspaper in question will perhaps be of interest.

The Gus-Krustalny Combination, over two years ago, ordered from the G.E.T., transformers, motors, cables, &c., the prices quoted by the latter being comparatively normal, that is to say, double those of pre-war days. A considerable part of the equipment was not executed in accordance with technical requirements. As a consequence a batch of the 6,000-V motors (the general capacity of them exceeded 2,000 h.p.), which cost about 150,000 roubles, was rejected owing to faulty insulation of the windings. The same happened with 142 500-V motors, costing 120,000 roubles; these were refused on account of faulty bearings. No defects, however, were discovered in the remainder of the order.

Serious difficulties are said to have been caused by the non-execution of orders at the due time. The combination placed orders for 6,000-V motors to be delivered on May 1st, 1925. As those motors proved to be useless, the G.E.T. has promised to supply others by August, 1927, so that a delay of almost two years and a half will have taken place in the completion of the order. The unreliability of the trust is stated to have involved the combination in considerable loss. It had a contract with the Moscow supply undertaking (the M.O.G.E.S.) for the consumption of 8,000,000 kWh per annum, but in consequence of the absence of the equipment, it has been unable to fulfil the contract, and the supply authority is now claiming 151,000 roubles as a penalty. Moreover, the combination has suffered loss through having to use steam power instead of the cheaper electrical energy, and the total losses through the default of the Trust are put at over 300,000 roubles.

The Gospromtsvetmet, on December 9th, 1924, gave the Trust an order for the equipment for a transformer station of the value of 37,000 roubles, the period of delivery being fixed at eight months. The contract has not been carried out down to the present time, however. In March, 1925, this undertaking placed a new order with the Trust for delivery in ten months of two 300-h.p. motors, two liquid rheostats, &c. The motors and rheostats were delivered in March, 1926, but without any starting equipment, so that the plant was unserviceable. The order, however, was completed in April of the present year after representations had been made. The delays thus experienced forced the undertaking to purchase machines from abroad. As to the quality of the Russian machines, it is mentioned that the motors have a larger consumption of energy than is stipulated by technical rules; and cases are stated to have arisen when the motors at no load consumed more energy than when they were loaded. Complaints have also been made of the bad quality of the motor bearings, and of the construction of one uneconomical type of motor, as compared with the foreign practice of turning out special motors for particular purposes.

The Rezinotrest (Rubber Trust) is stated not to have ordered much from the Trust, as it has obtained considerable assistance from the equipment removed from Riga during the war period from the works of the Provodnik, including a large number of motors of different sizes. In a few cases, plant has been ordered from the Trust, but this has not always been delivered to time. Thus the Rubber Trust three years ago placed orders for oil-break switches, but the work has not been completed down to the present time, and the same applies to distributing boxes which were to have been supplied in March, 1926.

The Central Telegraph Office, according to a statement made by M. Rerberg, says that although machine construction is still a young branch in Russia, a number of reproaches has to be levelled at it, particularly with regard to motors. If small motors of up to 72 h.p. are ordered from the Trust, it is necessary to wait a year for delivery, which is excessive. Moreover, the prices of Russian motors are high. Thus, for instance, a motor of ½ h.p., which Berlin firms offer at 66 marks, is priced by the Russian Trust at the high figure of 250 roubles.

Results of the "W.O.B." Ballot.

A Bristol Lady wins the All-Electric Home.

THE announcement of the result of the ballot which formed the popular side of the E.D.A.-E.L.M.A. Campaign will set at rest the minds of those who have been building castles in the air, or imagining an all-electric home in the suburbs.

A Bristol lady (Miss E. Gardiner) was the winner of the first prize and thus had the opportunity to become the possessor of a well-designed all-electric house, but she preferred the alternative, a cheque for £2,000. Neither of these is to be scorned in these days of scarcity of houses and money. In accordance with the terms of the competition, Messrs. J. H. Winter & Co., Bristol, who supplied the booklet containing the ballot paper to Miss Gardiner, receive a cash prize of £25. In the same way the Mid-Cheshire Electricity Supply Co., Ltd., and the South Metropolitan Electric Light and Power Co., Ltd., receive £10 and £5 respectively for providing booklets to the second and third prize-winners. The shareholders of the South Metropolitan Co. can calculate what this means in the way of extra dividends.

If we are to be guided by the opinions of the 150,000 people whose ballot forms were tabulated, the merits of electric lighting in the home assume the following order:—It is convenient, clean, it saves work, is economical, safe, adaptable, reliable, simple to control, it preserves the sight, is fumeless, cheerful and artistic. However near cleanliness is to godliness, it is a long way behind convenience, securing only 28,299 votes against 44,787. Although Scotland was very active in the Campaign, sheer weight of numbers forced economy into the fourth place. The "highbrows" of the industry will derive gloomy satisfaction from the fact that the artistic value of electric lighting received only 943 votes.

We reproduce below the full list of prize-winners with the relevant details:—

FIRST PRIZE.

(A freehold house fully wired and equipped with electric lighting, cooking, heating and labour-saving devices; or, alternatively, a cheque for £2,000.)

Miss E. Gardiner, Bristol.

Booklet supplied by Messrs. J. H. Winter & Co., Bristol, who receive £25.

SECOND PRIZE.

(Electric lighting installation and/or electrical domestic appliances to the value of £200.)

Mrs. S. Gleave, Acton, near Northwich.

Booklet supplied by the Mid-Cheshire Electricity Supply Co., Ltd., which receives £10.

THIRD PRIZE.

(Electric lighting installation and/or electrical domestic appliances to the value of £100.)

Mr. H. G. A. Newman, Catford, S.E.6.

Booklet supplied by the South Metropolitan Electric Light & Power Co., Ltd., which receives £5.

OTHER PRIZES.

No. of Prize.	Nature of Prize.	Winner.	Supplier of Booklet.
4th	Appliances to the value of £50.	Miss J. Nicholson (Leigh, Lancs.).	Brown & Co., (Manchester).
5th	Appliances to the value of £25.	Mrs. Gardiner (Bristol).	J. H. Winter & Co., (Bristol).
6th	Appliances to the value of £10.	Mr. N. N. Spratt (Purley).	Croydon Electricity Supply Dept.
7th	Appliances to the value of £5.	Mrs. S. F. Spears (Wolverhampton).	B.E.D.A.
8th	ditto	Miss D. Dearden (Lr. Bebington, Ches.).	St. Helen's Electricity Dept.
9th	ditto	Mr. J. W. Ellison (Blackheath).	South Metrop't'n. E.L. & P. Co., Ltd.
10th	ditto	Mr. W. H. Hill (Bradford).	Bradford Electricity Department.
11th	ditto	Mr. D. L. Hughes (Bangor, N. Wales).	G. Tilston (Bangor).
12th	Appliances to the value of £2 10s.	Mrs. Hastie (Paisley).	R. F. Cook (Paisley).
13th	ditto	Miss L. Montgomery (St. Helens).	J. Blaylock (St. Helens).
14th	ditto	Mr. E. Sparks (Teddington).	Bentall's, (Kingston-on-Thames).
15th	ditto	Miss S. Woods (Newnham, Cambridge).	Cambridge E.S. Co., Ltd.
16th	ditto	Mr G. S. Bullock (Shelton, Stoke).	Stoke-on-Trent Electricity Dept.
17th	ditto	Mr. A. S. Grice (Leicester).	Leicester Electricity Department.
18th	ditto	Mr. E. O. Mathias (Neath, Glam.).	Neath Electrical Co., Ltd.
19th	ditto	Mrs. Routh (Gt. Chesterford, Essex).	Baily, Grundy and Barrett, (Camb'ge)
20th	ditto	Miss I. W. Trace (Eastville, Bristol).	E. W. Palmer (Eastville, Bristol).
21st	ditto	Miss J. A. Patterson (Dalbeattie).	Dalbeattie E.L. and P. Co., Ltd.
22nd	ditto	Miss B. M Housby (Ipswich).	Ipswich Electricity Department.
23rd	ditto	Mrs. A. Ashton (Prestwich, nr. M/R).	Manchester Electricity Dept.
24th	ditto	Mrs. F. M. Dodsworth (Heworth, Yorks.).	H. Etherington (York).
25th	ditto	Mr. S. R. Nixon (Sutton Coldfield, nr. B'ming'm.).	B.E.D.A.
26th	ditto	Mr. A. Weatherill (Doncaster).	Doncaster Electricity Dept.
27th	ditto	Mrs. A. Harwood (Maida Hill, W. 9).	Metropolitan E.S. Co., Ltd.
28th	ditto	Mrs. I. B. Jackson (Bickley, Kent).	E. Fellingham (Brighton).
29th	ditto	Mrs. McGardell (Glossop, nr. M/R).	Urban Electric Supply Co. Ltd.
30th	ditto	Mrs. E. C. Greaves (Palmers Green, N.13).	North Metropolitan E.P.S. Co.
31st	ditto	Major A. J. French (Chiswick, W.4).	Chiswick Electric Supply Co.
32nd	ditto	Mrs. Bryon (Basingstoke).	Basingstoke Electricity Dept.

A Lancashire Electricity Scheme.

Suggested application of the provisions of the Electricity (Supply) Act, 1926, to the South-East Lancashire Electricity District.

THE South-East Lancashire Electricity Advisory Board (Manchester), which commenced to function in 1923, controlling an area delimited by the Electricity Commission in 1920, in an endeavour to apply the general principles of the Electricity (Supply) Act, 1926 (so far as it understands them) to its own area, has drawn up a technical scheme for that purpose which it unanimously adopted at its meeting on May 24th, 1927, and at the same time adopted the following resolution:—"That the Board agree to afford facilities to, and co-operate with, the Commissioners in connection with the preparation of a scheme to be prepared by the Commissioners for this District."

From an integrated load curve prepared to indicate the maximum load on the whole of the undertakings within the S.E.L.E. District during the month November 27th to December 24th, 1925, and the calculated load factor at each undertaking, the following figures have been ascertained:—Maximum simultaneous demand on feeders (Tuesday, December 22nd, 4.30 p.m.)=313,823 kW. Energy delivered to feeders during the year ended December 31st, 1925 (annual load factor, 30.5 per cent.)=839,479,123 kWh. Energy sold=708,069,467 kWh. Summation of individual demand=323,839 kW. Diversity factor=1.032, or 3.2 per cent. If the normal growth of consumption continues, it will reach 525 kWh per head in 1940 (population, 3,559,500; kWh sold, 1,870,000,000). During 1923-24-25 the kWh sold amounted to approximately 80 per cent. of the total generated, on which basis the total generated in 1940 to provide for the above-estimated consumption will need to be 2,337,500,000 kWh; assuming a combined load factor for the generating plant of 31 per cent., the maximum simultaneous demand on the generating stations will be 862,000 kW.

The S.E.L.E. Advisory Board assumes that the potential demand in the comparatively large areas within its District of a rural character which have not yet been developed will be relatively small, and not materially affect its scheme; it has not taken cognisance of possible demands for railway supplies. It is suggested that the maximum demand should be allocated to 16 possible selected generating stations comprising: 14 existing ones of 450,000 kW total, 5 of which it is proposed to extend by 195,000 kW total; two new stations of 52,500 kW total are under construction, which it is proposed to extend by 75,000 kW total, and 4 new stations of 312,500 kW total are contemplated. Therefore, the plant installed would total 1,085,000 kW, and suggested extensions would mean a surplus of 223,000 kW, or 20 per cent. Of the 14 non-selected generating stations only 6 (50,000 kW total) would be utilised in case of emergency. The base load (172,400 kW, or 20 per cent. of the maximum) could, it is suggested, be allocated to 3 stations.

The total capital cost would be £12,878,307; the cost of 1,555,503 tons of fuel would be £1,244,402, or 1.57 lb. per kWh, while the total cost of delivery to the feeders in 1940 would be £3,064,335, or 0.3313d. per kWh.

In addition, the provision of 232.25 route miles of 33,000-volt transmission lines (of which 36.2 miles, costing £262,555, are already in existence) would be £1,677,033, and switchgear, transformers, protective gear, and cables would also cost £602,630. With few exceptions, the maximum transmission distance during the period of maximum demand would not exceed five miles.

Accordingly, the total annual cost of delivering energy into the areas of authorised undertakers in the S.E.L.E. District, omitting the administrative expenses of the Central Electricity Board, would be £3,064,335 (transmission accounting for £214,480), the energy delivered amounting to 2,108,975,000 kWh, of which 1,149,560,000 kWh would be for owners of selected stations; therefore, the cost per kWh to receiving undertakings would be 0.4023d.

The scheme contemplates the standardisation of the frequencies of all undertakings in the district, but the cost of doing so is not mentioned.

Technical considerations only have been dealt with, the rights of individual undertakers, ownership of plant, existing bulk-supply contracts, &c., having been ignored entirely. The S.E.L.E. Advisory Board has expressly refrained from putting the scheme forward as a recommendation within the meaning of its District Order of 1923, regarding it rather as indicative of a method of developing the area, provided that the Central Electricity Board could carry it into effect and that any claims of authorised undertakers for relief or compensation under the Act were duly met.

It is not suggested how the S.E.L.E. District is to be linked with surrounding areas and the national network.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

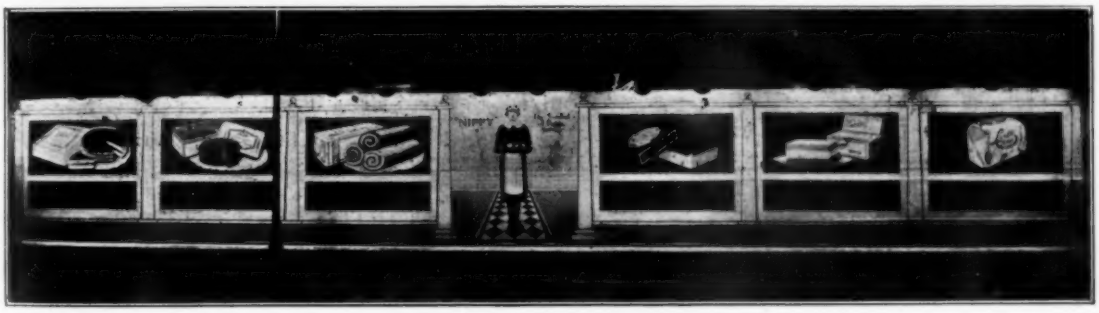
The A.E.U. Annual Conference.

The *Daily Telegraph* reports that Mr. J. T. Brownlie, president, speaking at the ninth annual meeting of the National Committee of the Amalgamated Engineering Union, recently, said he viewed with alarm the gradual falling-off in the membership of the union. Last year there was a decrease of 14,400. Referring to the Southern Railway contract going to Sweden, Mr. Brownlie said the company's explanation was that its action was directed against the ring in this country. He did not deny that rings existed, but they were part of the logical development of industry, and had to be recognised. He deprecated municipalities sheltering behind this action in buying in the cheapest market abroad, and giving the reason that they were spending ratepayers' money. He did not share that point of view.

The question of wages was discussed on May 25th, when the conference instructed the Executive Council to continue negotiations to secure an advance of wages in excess of the offer made by the employers on May 19th. It was provided that a ballot of members should be taken on any further offer. A resolution providing for setting up of a committee to examine the whole system of payment by results was rejected.

Hoarding Illumination.

By the courtesy of Messrs. J. Lyons & Co., Ltd., we are able to reproduce a night photograph of one of their hoardings. By means of floodlighting, this hoarding is made to give a 24-hour service. The installation comprises 14 "Benjamin" elliptical angle reflectors (two for each panel) with a 100-W lamp in each, spaced approximately five feet apart.



An Illuminated Hoarding.

French Radio Exhibition.

The fourth French wireless exhibition is to be held from October 28th to November 13th, in the Grand Palais, Paris. It is being organised under the auspices of the Syndicat Professionel des Industries Radio-Electriques, and the exhibits will be confined to members of that association.

A Report upon Esthonia.

The British Consul-General at Reval (Mr. H. Montgomery Grove) has prepared for the Department of Overseas Trade a report upon conditions in Esthonia (Stationery Office, 1s. net). Esthonia is a new republic with a rather eventful history; it is mainly an agricultural and pastoral country, and its population is only about 1,200,000. The last factor limits its importance as a market. In 1925 the imports of electrical machinery and apparatus were valued at 129 million Esthonian marks (about £645,000); of this Germany supplied goods to the value of 74 million E.mks. and Great Britain 9 millions, of which wires and cables account for 7 millions. Mr. Grove says that the use of electricity is increasing and also the demand for electrical goods. The question of the construction of the power station upon the Narva Falls is still not settled. Germany's trade with Esthonia is larger than Great Britain's for several reasons, but there is further scope for British goods, which are favourably regarded by the people of the country. The main obstacle to trade is the problem of credit.

Valve-making at Whiteley's.

For a period of 10 days, until June 10th, the GENERAL ELECTRIC CO., LTD., has transferred some of its radio valve-making machinery from the Osram Valve Works, Hammersmith, to the newly-opened wireless department at Messrs. Whiteley's. This will enable the numerous visitors to the stores to gain an idea of the delicate work involved in the production of valves.

A New Idea for the Window.

How often one hears such comments as "I didn't know that before" made by the user concerning some particular appliance which has caught the fancy! One can run through a list of domestic electrical appliances and find no difficulty in marking a round dozen about which a similar observation could be made by hundreds of the type whom it is our desire to interest in the all-electric home. Then why not the "Little Known Use" window? This opens up a new idea in display, with a considerable public interest at the end of it. There is plenty to put into the window, and one might start with the electric egg whisk, hot plate, massage vibrator, curling iron heater, millinery iron, shaving pot, pipe and cigarette lighter, and go on to the coffee percolator, hair dryer and dimmed night light. There should be plenty of space and no overcrowding, and an attractive background in colour as a set-off to the appliances. This is the place in which to describe the purpose of the display in a few words—"You can do *all* these operations electrically," or "Do it electrically in these delightful ways." The only other wording that is needed will be fixed to the inside of the window glass: "Your ideal domestic servants" will be found eminently appropriate and provocative. From this will depend a paper streamer directing the eye to each different appliance shown, the latter identified by name in each case, as "Egg Whisk," "Millinery Iron," and so on. In such ways will the required larger market be found for what are, comparatively speaking, little known applications of electric service. Hitherto they have been largely allowed to take care of themselves.

Electric Power in Industry.

The thirteenth preliminary report upon the 1924 Census of Production (*Board of Trade Journal*, May 26th), deals with trades connected with beverages. The brewing and malting trades reported 6,454 kW of generating plant (as compared with 2,884 kW in 1907) and electric motors aggregating 65,277 h.p., power for 57,530 h.p. of which was purchased. In the aerated waters, cider, vinegar, British wine and cognate trades there was 210 kW of generating plant (as against 191 kW in 1907), and there were motors totalling 7,886 h.p. (power for 7,555 h.p. purchased). The generating plant installed in the wholesale bottling trade rose from 144 kW in 1907 to 461 kW in 1924. The capacity of electric motors installed was 7,868 h.p., power for 7,502 h.p. of which was purchased.

Proposed French Tariff Revision.

The *Board of Trade Journal* for May 19th published a translation of the proposed revised tariff for goods imported into France. The new rates affect turbines, boilers, wires and cables, fans, electro-magnets, and other electrical apparatus.

Social Events.

The annual London G.E.C. social and athletic sports meeting will take place at the G.E.C. Sports Grounds, Wembley, on Saturday, June 11th, when amongst many other interesting items the various G.E.C. London championships will be decided.

The annual summer outing of the staff of the London Electric Wire Co. & Smiths, Ltd., was held on Saturday last, a very enjoyable day being spent at Worthing. The party travelled in three motor coaches.

Recent Contracts.

An important contract, covering the supply of all the outdoor and indoor switchgear required for the Perak River hydro-electric scheme in the Malay Peninsula, has been placed with the Metropolitan-Vickers Electrical Co., Ltd. The scheme, which is being undertaken by the Perak River Hydro-Electric Power Company, is a project for supplying electricity in the Kinta Valley tin mining district. It includes the provision of a main water-power station at Chenderoh with a 66,000-V transmission line extending about 65 miles to the South, fifteen sub-stations to distribute the power at 22,000 V and 6,600 V, and a stand-by steam power station at Malim Nawar near the southern end of the system. The switchgear to be supplied by the Metropolitan-Vickers Co. includes over a hundred oil circuit breakers and about 70 isolating switches for 66,000, 22,000 and 6,600 V, together with all the necessary constructional steelwork for outdoor installation. Twenty-eight of the 6,600-V circuit breakers, in seven sub-stations from which power will be supplied to consumers, will be motor operated and equipped with automatic reclosing devices for rapid restoration of service after temporary faults. The contract also includes the control board and switchgear for the station, accessories for the main power station and an 8-panel switchboard of 6,600-V metal-clad units for the steam power station at Malim Nawar.

The success of the electric cooking equipment installed by the General Electric Co., Ltd., in the M.S. *Pieter Corneliszoon Hooft* for the Stoomvart Maatschappij Nederland, has led to a further order to the company for a similar equipment for the sister ship *Chr. Huygens*.

A Profit-sharing Scheme.

MESSRS. HORACE GREEN & CO., LTD., Cononley, Keighley, held their fourteenth annual employés' meeting on May 6th, when 6 per cent. profit was distributed to the employés. Though this is less than in previous years, it is considered quite satisfactory under the conditions prevailing during the past year.

Radio Manufacturers and Wholesalers.

The Radio Manufacturers' Association states that it has received information which would lead to the inference that radio wholesalers in certain parts of the country are considering the formation of local wholesale associations. The R.M.A. is of opinion that any co-operative movement should be national and not local in character, as only in a national body can matters affecting the industry be viewed in their correct proportions. It adds that it would welcome the formation of a national body of wholesalers and would be willing to co-operate to the fullest possible extent.

A Successful A.E.G. Claim.

Before the Second Division of the Anglo-German Mixed Arbitral Tribunal on May 25th, the Allgemeine Elektricitäts Gesellschaft, Berlin, claimed the return of a sum of £414 deposited with the Government of Western Australia before the war as security in connection with a contract for switchgear, &c. It was stated for the respondents that owing to the non-fulfilment of the contract in consequence of the outbreak of war the Government was forced to pay £60,000 to get the equipment elsewhere, although the contract price was only about £13,000. It was urged that the claimants were not entitled to the return of the deposit because the conditions by which it would have become repayable never came into force The Tribunal held that the outbreak of war made it impossible for the claimants to carry out the contract and that there was nothing in the contract to justify the respondents retaining the deposit. It therefore awarded the amount claimed, with five per cent. interest from August 4th, 1914.

Canadian Order for Sweden.

The Allmänna Svenska Elektriska Aktiebolaget has recently obtained an order for two 16,000-h.p. generators for the extension of a Canadian hydro-electric power station to which the company had previously supplied complete machinery. The value of the order approaches Kr. 700,000.—*Reuter's Trade Service* (Stockholm).

New Municipal Showrooms.

Commodious new showrooms for the Electric Supply Department of the Birmingham Corporation were opened at Station Road, Solihull, recently, by Mr. H. K. Beale, the chairman of the Committee. At a luncheon following the ceremony, Mr. Beale said that the department had laid 37 miles of cable in the Olton, Shirley, and Solihull districts, representing an expenditure of £53,000, and there were now 570 consumers there.

Midland Building Trades Exhibition.

An exhibition which is being organised by the Birmingham and Midlands building trades is to be held at Bingley Hall, Birmingham, from September 5th to 17th next, during which conferences will be held on the most recent developments in the building and allied trades. An important part of the proceedings will be lectures and discussions upon electrical services for lighting, cooking, heating, the provision of hot water, &c.

Unemployment.

There was an increase of 8,710 in the number of unemployed during the week ended May 16th. The total at that date was 1,007,000, as compared with 998,290 on May 9th, and 1,612,740 on May 17th, 1926.

Trade Announcements.

To meet the requirements of expanding business the Glasgow branch of the three associated companies, the LONDON ELECTRIC WIRE CO. & SMITHS, LTD., the LIVERPOOL ELECTRIC CABLE CO., LTD., and FREDERICK SMITH & CO., have moved into more commodious premises at 74, York Street, Glasgow. (Telephone: Central 9002; telegrams: "Lewcos Glasgow.") Large stocks of all materials manufactured by the three companies will be available for immediate delivery.

MESSRS. F. THOMAS & CO. have opened larger showrooms at 189-191, Drummond Street, Hampstead Road, N.W.1, for the sale of lighting fittings, including glassware and alabaster bowls. Prices have been reduced as from June 1st.

The address of the CLARKSON THIMBLE TUBE BOILER CO., LTD., is now 613, Australia House, Strand, W.C.2. Telephone: Central 2882.

Mr. FRED G. CAVE, radio engineer, has opened new showroom premises at 102, Abington Street, Northampton.

MESSRS. BENNETT & BROWN, radio and electrical goods dealers, have opened new premises in Old Road West, Gravesend.

New Catalogues and Lists.

THE MILLNS ELECTRICAL CO., 17, Whitefriars Street, E.C.4.—Booklet P.669a, containing illustrated notes upon the firm's organ-blowing equipment and a long list of places in which it has been installed.

ALLOY WELDING PROCESSES, LTD., 14-16, Church Street, Islington, N.1.—Bulletin No. 52, describing the new "A.W.P." system of polyphase working, and illustrating the apparatus and its use.

MESSRS. HEYES & CO., LTD., Water-Heyes Electrical Works, Wigan.—Leaflets Nos. 8D and 8E, dealing respectively with a water- and gas-tight emergency switch, and a transformer switch plug. Illustrated.

BRITISH INSULATED CABLES, LTD., Prescot, Lancashire.—Catalogue P.209, for the use of electrical contractors, containing illustrated particulars of the "Helsby" twin wiring system, wires of various kinds, insulators, fuse-boxes, switch-fuses, jointing materials, &c.

MESSRS. WM. GEIPEL & CO., Vulcan Works, St. Thomas Street, S.E.1.—An illustrated pamphlet advertising Ward Leonard "Vitrohm" dimmers for theatre lighting.

The SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—Supplement to the company's radio catalogue, containing revised prices, alterations, and particulars of new lines.

The CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—Supplement to List No. 157, describing a new illuminated dial CO_2 indicator.

MESSRS. ROBERT HORNBY & CO., LTD., 77, Dean Street, Soho, W.1.—An illustrated catalogue and pamphlets dealing with "Siemens-Schuckert" electricity meters, including prepayment and time-switch types.

THE MACINTOSH CABLE CO., LTD., St. James's House, St. James's Street, S.W.1.—Three uniform lists, the first of a series, dealing respectively with "Maconite," trailing cable, and a bonding plate for lead-covered "Maconite." Fully illustrated and detailed.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—An illustrated and priced folder describing the "Benjamin" electric fire, which embodies several new features.

VAMPIRES, LTD., 435-437, Oxford Street, W.1.—Two illustrated pamphlets advertising the "Vampire" suction cleaner and the "Dandy" floor polisher.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—List Ma64, containing an illustrated description of the company's rotating standard testing set for a.c. meters. Priced.

HIGGS MOTORS, Witton, Birmingham.—May-June stock list of a.c. and d.c. motors. Priced.

The MULLARD WIRELESS SERVICE CO., LTD., 21, Denmark Street, W.C.2.—Pamphlets W.A.8, illustrating and describing the company's cone-type loud speaker; and W.A.9, dealing with "Mansbridge" condensers. Both pamphlets are priced.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—A circular, dealing with the "Pearl Elasta" lamp.

Bankruptcy Proceedings.

PAUL J. WHITE (trading as P. J. White & Co.), 5, Dyers Buildings, Holborn, W.C.—The public examination of this debtor was held on May 24th, at the London Bankruptcy Court, before Mr. Registrar Mellor. The statement of affairs showed liabilities of £6,067, and assets of £40. Replying to Mr. Gaine, Official Receiver, the debtor stated that he was born in Bohemia, and was naturalised in March, 1913, changing his name from Weiss to White. In September, 1919, he registered P. J. White & Co., Ltd., to deal in goods obtained from the Ministry of Munitions Disposals Board; that company went into voluntary liquidation in January, 1924. In July, 1922, he formed Radio Equipment, Ltd., with a nominal capital of £100, and was appointed a director of the company at a fee of £500 per annum; a compulsory winding-up order

was made against this company in March, 1926, its liabilities amounting to £6,586, including £821 owing to him. In October, 1923, he caused to be registered Radio Works, Ltd., with a nominal capital of £100; he became a director of this company, which went into voluntary liquidation in February, 1926. In February, 1925, he obtained an order from Lighting, Heating & Glass, Ltd., he then acting as selling agent for a German company, for 5,000 gross yards of flex at £2,600, the flex being made by an Austrian company; the failure of the purchaser to take up the flex as arranged ultimately led to the present proceedings. The debtor further stated that only two shares in Radio Equipment, Ltd., were issued, one to himself and one to another person, so that the failure of that company was practically his own failure. He was to have had one-fourth of the share capital of Radio Works, Ltd., but the shares were never issued. He did not agree that Radio Works, Ltd., was merely another alias adopted to enable him to carry on business. Asked about six bills of exchange given to him by Lighting, Heating & Glass, Ltd., in payment for the flex, the debtor admitted that when he handed the bills to Radio Equipment, Ltd., that concern was overdrawn at the bank to the extent of £250 (which overdraft he had guaranteed), the result being that the proceeds of the bills were partly used to discharge the overdraft. The Official Receiver said that it was a very improper proceeding on debtor's part, and debtor admitted that it was irregular. With regard to a claim for £109 made by the liquidator of Radio Works, Ltd., the debtor stated that after that company went into liquidation, 547 headphones were sold for £109, which was used for his own purposes. He explained that he and another person really constituted the company. He had not returned that £109 as a debt in his statement of affairs for the reason that he regarded it as a matter between that other person and himself. He attributed his failure and insolvency to his inability to recover from Radio Equipment, Ltd., the proceeds of the bills of exchange which he endorsed to them. It was further due to the fact that his expenditure had exceeded his income by £887 during the last two years. The examination was concluded.

W. N. SMART, electrician, formerly of 181, Windsor Road, and 17, 19 & 19a, Cross Street, Oldham.—Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston, released May 16th.

D. E. DAVIES, wireless engineer, 19, Poulton Street, Kirkham, Lancaster.—Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston, released May 16th.

J. G. F. RENNIE, electrical engineer, 19, Bridge Street, Andover.—Trustee, Mr. T. Barton, Official Receiver, City Chambers, Catherine Street, Salisbury, released May 16th.

MRS. H. SPENCER (Spencer & Son), wireless and cycle dealer, 30, Watergate, Grantham.—Last day for proofs for dividend, June 8th. Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham.

A. H. DUFFIN and G. KERSHAW (A. H. Duffin & Co.), electrical engineers and contractors, Provincial Buildings, Conway Road, Colwyn Bay.—Supplemental dividend of 9d. in the £. Payable at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

F. LENG (F. Leng & Co.), electrical and mechanical engineer, 12, Godstone Road, Rotherham.—Receiving order made May 20th, on debtor's own petition.

I. STEPHENSON (I. Stephenson & Son), plumber and electrician, 36 & 37, Flowergate, Whitby.—Receiving order made May 19th, on debtor's own petition. First meeting, June 9th, at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. Public examination, June 16th, at the Court House, Bridge Road, Stockton-on-Tees.

F. C. GROSS, electrical engineer, 32, Windsor Road, St. Andrew's Park, and 71, North Road, Bishopston, Bristol.—Discharge suspended until July 29th, 1927.

J. A. BOSHER, 33, High Street, Aberdare, electrical engineer and contractor.—Trustee, Mr. S. E. Clutterbuck, 31, Queen Street, Cardiff, released March 30th.

W. E. OWEN (trading as Emlyn Owen & Co.), 1, Senghenydd Road, Cardiff, and Maesteg, wireless dealer.—Trustee, Mr. Ellis Owen, Official Receiver, 34, Park Place, Cardiff, released May 20th.

C. H. KITCHING, 20, St. Hilda Street, 172, Beverley Road, and 42, Chariot Street, Hull, plumber and electrical engineer.—Last day for proofs for dividend, June 14th. Trustee: Mr. J. E. D. Stickney, Official Receiver, 37, Scale Lane, Hull.

E. MORTIMER LANCASTER, THE YOUNGER, 41, Virginia Road, Leeds, electrical engineer.—Receiving order made May 25th on debtor's own petition.

Company Liquidations.

A. W. KNIGHT, LIMITED, Basinghall Street, E.C., radio engineers.—A meeting of creditors was held on May 24th at 65-66, Basinghall Street, E.C., when the chair was occupied by Mr. Rickard, the liquidator. An approximate statement of affairs was presented which showed liabilities of £1,324 and net assets of £143, leaving a deficiency so far as the creditors were concerned of £1,181, or a total deficiency as regarded contributories of £2,761. The chairman said that at the time of his appointment there was a possibility of being able to dispose of the business as a going concern, for a sum which would have met with the approval of the unsecured creditors. He had since received an offer of £75 for the assets. No resolutions were passed, and the matter therefore remains in the hands of the present liquidator. The following are creditors:—

	£		£
Edison Bell, Ltd. ...	416	Stevens, Col.	100
Schneider, —	84	Wilson, H. W.	294
Knight, —	45		

MESSRS. YATES & THOM, Canal Foundry, Blackburn, engineers and boiler makers.—It is recommended that this company should go into voluntary liquidation. Sir Wm. Thom, principal of the concern, says that if this step is now taken the assets of the company will be fully preserved. In a letter to the shareholders, he states:—"The steady advance in the use of electricity, and the numerous large power stations erected in various parts of the country, are making great inroads into our business. This competition will continue and become more severe. For some time we have found it impossible to keep our men and machines working at anything like a reasonable production. Every endeavour has been made to find new manufactures to increase output, but without success. A turnover to a new branch of engineering would entail a large capital expenditure, coupled with considerable risk and doubtful results. The company is financially sound, but the general trading is being carried on at such a loss that a few more years under similar conditions will result in a loss to the shareholders, which to-day can be avoided."

DISTRICT LIGHTING SUPPLY, LTD., 87, Tottenham Court Road, W., dealers in electrical and radio appliances.—A meeting of creditors was held recently, at the Cannon Street Hotel, when Mr. C. S. Steel, C.A., 34-36, Gresham Street, E.C., the liquidator in the voluntary liquidation of the company, presided. The chairman said that it had been impossible to prepare an accurate statement of affairs, but he estimated that the liabilities due to the trade amounted to £810, and there were loan creditors for £654. The only asset, so far as he could ascertain, was the stock valued at £350, which might realise from £200 to £250 on a forced realisation. The company was registered on May 22nd, 1925, with a nominal capital of £1,000, to acquire a business formerly owned by Mr. B. Apple, who traded under the style of the District Lighting Supply. From the inception of the company to the end of May, 1926, there was a loss on trading of £113. Mr. Steel said that upon purchase the goodwill was put down at £50, fixtures and fittings £200, and furniture, stock, &c., £750. The total of £1,000 was satisfied by the allotment of 1,000 shares of £1 each. The trade liabilities taken over amounted to £700. The directors of the company were Mr. Apple and his wife. The liquidator said that the case was unsatisfactory in some respects, and required a good deal of investigation. Mr. E. H. Hawkins proposed that unless a guaranteed offer of 10s. in the £ was forthcoming within fourteen days the liquidator should be requested to apply to the Court for the compulsory liquidation of the company, and the resolution was carried. The following are creditors:—

	£		£
Freedman, L.	309	Bryan, G. A.	49
Anglo Trading Co. ...	176	S.M.T. Gramophones ...	38
Notting Hill Loan & Investment Society ...	171	Artistic Lamp Shade Co.	36
Brown Bros., Ltd. ...	130	Eaton & Son	31
London Commercial and Electrical Stores ...	63	Foot, R. W.	30
Johnson Talking Machine Co.	50	Simpson & Taylor ...	29
		Sanders Electrical Co....	20
		Heath, S., & Sons, Ltd.	20

ELECTRICAL AND RADIO DISTRIBUTORS, LTD., 71, Monks Park, Wembley.—A meeting of creditors was held on May 25th, at the offices of Mr. F. E. Anderson, I.A., 20, Bedford Row, W.C., the liquidator of the company. No statement of affairs was presented, but according to a balance sheet as at March 31st, 1927, it appeared that the authorised capital was £500, in shares of £1 each, and the fully-paid issued capital was £265. The company was registered on October 22nd last, and from then until the date of liquidation, the purchases were £1,135, the sales were £1,150, and there was a gross profit of £37, and a net loss of £326. The matter was left in the hands of Mr. Anderson as liquidator. The following are creditors:—

	£		£
Barnard Accumulator Co.	38	Beaver Electric Supply Co.	40
Sel-Ezi Wireless Supply Co.	31		

BRITISH ELECTROLYTIC ZINC (ISHERWOOD PROCESS), LTD.—A meeting of members is called for July 1st, at Pinners Hall, Austin Friars, E.C., to hear an account of the winding up from the liquidator, Mr. E. Fairweather.

HOLBROOK'S ELECTRIC SERVICE CO., LTD.—A meeting of creditors is called for June 8th, at the offices of Messrs. Chantry, Button & Co., 61-62, Lincoln's Inn Fields, W.C.2. Claims to be sent forthwith to the liquidator at the above address.

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UNITED ELECTRIC CAR CO., LTD., AND DICK, KERR & CO., LTD.—Meetings of members are called for June 28th, at Queen's House, Kingsway, W.C.2, to hear an account of the winding up from the liquidator, Mr. G. R. Freeman.

R.M.P., LTD.—Winding up voluntarily. Liquidator, Mr. N. A. Denson, 26, Corporation Street, Birmingham, appointed May 25th.

VEE CEE DRY CELL CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. M. West, 1, Station Road, Reading. Meeting of creditors held June 1st.

HIGH SALVINGTON ELECTRIC SUPPLY CO., LTD.—Winding up voluntarily. Liquidator, Mr. R. Dixon. Meeting of creditors June 6th, at 37, Walbrook, E.C. Particulars of claims by June 3rd to Messrs. Marsh & Ferriman, Arundel House, Liverpool Gardens, Worthing, solicitors to the liquidator.

MEASUREMENT (AUSTRALIA), LTD.—Winding up voluntarily. Liquidators, Messrs. J. T. Fitz, Australia Street, Camperdown, Sydney, New South Wales, and A. Gordon, 7-17, Fitzalan Street, Kennington Road, S.E.11. Meeting of creditors held June 1st. (This notice is formal; all creditors have been, or will be, paid in full.)

Dissolutions of Partnership.

G. STARKS & CO., accumulator manufacturers, 22, Shirley Road, Southampton.—Mr. G. Starks and Mr. R. E. Jones have dissolved partnership.

SMITH & SNAPE, decorators and electrical engineers, 114, Devonshire Street, Sheffield.—Messrs. H. H. & S. Snape have dissolved partnership; the former is continuing the business.

H. G. HOAD, electrical engineers, Ashford, Middlesex.—Messrs. H. G. Hoad and F. R. J. Sears have dissolved partnership. Debts will be attended to by Mr. Sears.

ABINGDON WIRELESS SUPPLIES, manufacturers and dealers in wireless apparatus, Abingdon, Berks.—Messrs. E. S. Langford and A. E. Basford have dissolved partnership. Mr. Basford will attend to debts.

Book Notices.

"Kelly's Directory of the Merchants, Manufacturers and Shippers of the World." Two vols. (Pp. 4,541.) London: Kelly's Directories, Ltd. Price 64s., post free.—This is the 41st edition of the directory; it contains more than a million and a half names, and deals with over 20,000 places. Apart from this, all manner of commercial information is given, and reference is facilitated by a concise explanation of the arrangement of the matter. With the volumes is circulated a reproduction of a specimen proof page showing the great amount of revision which is necessitated by the changes of a year.

"The Marconi Short-wave 'Beam' System." Pp. 28; 25 figs. London: Marconi's Wireless Telegraph Co., Ltd.—This well-printed publication, though not containing anything new, is a useful *résumé* of the essential features of "beam" radio-telegraphy that should find a place in reference libraries. Written in a non-technical manner, it clearly outlines the system; the principal characteristics are illustrated by diagrams and photographs, and typical short-wave stations in this country are described.

"Faraday House Journal." Vol. XII, No. 3, Summer Term.—Besides news items, this number contains articles on "Super-tension Cables in Cast-iron Pipes," by Mr. G. W. Preston, and on "The Manufacture of Air-spaced Paper-covered Multiple-twin Telephone Cable," by Mr. E. N. Bronsdon, while Mr. D. W. Thorpe explains how one may add to one's income by "The Writing of Technical Articles."

"Science Abstracts (A. & B.). Vol. XXX. Part 5. May 25th, 1927. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Scientific Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 545. "Determination of the Magnetic Induction in Sheet Steel." Price 10 cents.

"National Research Council of Japan." Japanese Journal of Physics; Transactions and Abstracts. Vol. IV, No. 2. 1926-27.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI, May, 1927. New York: The Institute. Price $1.

"Theory of Machines," by L. Toft and A. T. J. Kersey. Pp. ix+408; figs. 272. London: Sir Isaac Pitman & Sons. Price 12s. 6d. net.

Wire Manufacture in Chile.

In order to render Chile independent of foreign markets for many manufacturing elements, including those used in the electrification of railways and the lighting services, a concession has been granted for a factory to manufacture copper wire. Raw materials (copper ore and sulphuric acid) abound in Chile, and the factory will be able to produce copper wire of greatest purity. Insulated and non-insulated wire will be manufactured, also copper and brass plates and bars, tubing, wire ropes and concentric bare or insulated cables for high-pressure transmission. The factory will contain rolling, tubing, insulating and cutting machines, and at least one large wire-drawing machine.—*Reuter's Trade Service* (Santiago).

Span-wire Suspension.

Referring to the report recently abstracted in this journal on "The Problems of Public Lighting by Electricity," by Lieutenant-Commander Haydn T. Harrison, touching the public lighting in the City of London, in which it is asserted that the main streets of the City of London are the best examples of lighting in the world, the London Electric Firm reminds us that the lamp-lowering gear (both electric and gas) was supplied by it in 1911 and has been in continuous use ever since, with the minimum of cost for maintenance and repairs, and immunity from accidents. The gear consists of the makers' well-known contact suspension gear and a self-sustaining winch by means of which the lamps are suspended in the centre of the road, where the highest efficiency is obtained, and are first traversed along the wire to the side walk and then lowered so as not to interfere with wheeled traffic.

New Belgian Company.

A company has lately been formed at Machelen, Brussels, with a capital of 2½ million francs and the title La Société Independante de Construction et d'Exploitation Radio-Electriques, to manufacture radio apparatus.

Works Visit.

On May 20th, a party of members of the Birmingham Electric Club paid a visit to the Siemens lamp works and certain shops of the English Electric Co., Ltd., at Preston. After luncheon at the Victoria and Station Hotel the party proceeded by motor-'bus to the electrical and car works of the English Electric Co., and afterwards made a thorough inspection of the lamp manufacturing processes. The guests were then conveyed to the Ashton Park Club for tea, after which a photograph was taken of the group on the steps of the club.

Sequestration.

E. MACKINTOSH, 57, Broughton Road, Edinburgh, electrical engineer.—Meeting of creditors held June 1st. Solicitor, Mr. R. F. Calder, 12, Gayfield Square, Edinburgh.

A New London Sign.

Mounted on the side of a tall building at the Trafalgar Square end of Whitehall is a new electric sign erected for the CHLORIDE ELECTRICAL STORAGE CO., LTD. The sign is 40 ft. long by 8 ft. high, and contains 434 lamps. A novel method of operation has been arranged. The first portion to operate is a star which flashes out Morse signals, spelling the word "Exide." On completion of the message, the border appears in red, followed in white, by the word "Exide," which is in turn succeeded by the slogan "The Long Life Battery."

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price May 31st.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	8½d.	—
a Ammoniac, Sal ... ... per ton.	£60	—
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£35	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	—
a ,, Perchlorate ... ... ,,	5½d.	—
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	—
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	—
b ,, Wire ... ... per lb.	1/6 to 2/-	—
b ,, Sheet ... ... ,,	1/8 to 2/9	—
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£256	...
Grade II ... ... ,, ,,	£171	...
Grade III... ... ... ,, ,,	£93	...
c Brass (rolled metal 3" to 12" basis) per lb.	9¾d.	...
c ,, Tubes (solid drawn) ... ,,	11½d. to 11¾d.	...
c ,, Wire, basis ... ... ,,	9¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	—
c ,, Bars (best selected) ... per ton.	£86	—
c ,, Sheet ... ... ,,	£86	—
c ,, Rod ... ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£69 5s.	27/6 dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£70 5s.	27/6 dec.
d ,, ,, H.C. Wire per lb.	8¼d.	¼d. dec.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/6½	1½d. inc.
i Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£25 15s.	10/- dec.
g Mercury ... ... per bot.	£22 10s. to £22 15s.	5/- dec.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/5	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£25	...
d Silicium Bronze Wire ... per lb.	10½d.	...
r Steel, Magnet, in bars ... ,,	7½d.	...
a Tin, Block (English) ... ... per ton.	£286 10s. to £289	5/- inc.
a ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.

W. F. Dennis & Co.

An Anglo-American Telephone Appointment.

Dr. H. R. Wright, managing director of Siemens Bros. and Co., Ltd., has joined the board of the British Columbia Telephone and Telegraph Co. (a Delaware (U.S.A.) Corporation with offices in Chicago), in which Siemens Bros. & Co., Ltd., hold a substantial financial interest. The British Columbia Telephone and Telegraph Co. owns a controlling interest in the British Columbia Telephone Co., Ltd., which operates nearly 100,000 telephones in British Columbia, with headquarters at Vancouver.

New French Company.

A company has been formed in Paris (10 Rue de la Fidelité) with the title La Société Rurale de Distribution d'Electricité, to establish hydro-electric plant in rural areas.

New Swiss Company.

The Gesellschaft für Elektrothermische Industrie Liesberg is the name of a company which has been formed at Barschwil (Solothurn) to manufacture electro-metallurgical and electro-chemical products.

Portuguese Duty on Irons.

The Portuguese Customs authorities have imposed an import duty (to take effect on July 1st), upon "electric smoothing irons," ranging from 0.30 to 0.10 gold escudos per kg.

For Sale.

Southampton Corporation Electricity Department has for disposal one 60-in. Davidson "Sirocco" induced draught fan complete with cover, &c., but without electric motor. Stafford County Mental Hospital invites offers for an electric lighting generating set. City of Sheffield Electric Supply Department has for disposal oil-cooled and air-cooled transformers, 0.75 to 1,000 kVA capacity. Darlington Corporation Electricity Committee invites offers for a 220/280-kW steam generating set. Sunderland electricity department has for disposal a quantity of second-hand meters. (See our advertisement pages to-day.)

Lighting and Power Notes.

Beckenham.—NEW PLANT.—The Urban District Council has applied to the Electricity Commissioners and to the London and Home Counties Joint Electricity Authority for sanction to install a 1,500-kW set, cooling tower, boiler, and accessories, estimated to meet the requirements for the next ten years, in place of the 3,000-kW set previously proposed, but not approved of by the Joint Authority.

Birmingham.—NEW ELECTRICITY TARIFF.—The City Council is to be asked to approve a recommendation of the Electric Supply Committee to introduce the "telephone system," as an alternative to the present flat-rate system of electricity charges. Under the new system, which, if approved, will be put into operation in September next, there will be a quarterly rental based upon ratable value, plus a charge of ¼d. per kWh for electricity used for all purposes. One meter and one wiring system will be installed for lighting, heating, cooking, &c. The scheme will be confined to private residences.

YEAR'S WORKING.—The accounts of the Electricity Supply Department for the year ended March 31st last show a surplus of £172,000, as compared with £184,000 in the preceding year, and it is proposed to contribute £31,000 to the borough fund. A record number of new consumers (10,300) were connected to the mains during the year.

Blackburn.—INQUIRY.—With reference to the note which appeared in our last issue under this heading, we are informed that Dr. S. L. Pearce is unable to comply with the Corporation's request to conduct an inquiry into the electricity undertaking owing to pressure of other business.

China.—SHANGHAI.—A net profit of Tls. 2,205,490 was realised by the Electricity Department of the Municipal Council in 1926. The total sales of electricity for all purposes were 408,245,810 kWh, and the revenue from sales of electricity, hire of motors, &c., was Tls. 10,051,221. The gross profit, after allowing for depreciation, was Tls. 3,930,539. There were 43,378 consumers at the end of the year, as compared with 38,932 at the end of 1925, an increase of 4,446. A total of 226,190 lamps were in service within the Settlement at the end of 1926.

Clitheroe.—EXTENSION OF SUPPLY.—The Corporation has instructed its consulting engineer to prepare a scheme for the erection of an overhead cable to the districts of West Bradford, Grindleton and Waddington, consequent upon guarantees having been forthcoming for the £5,000 estimated capital expenditure.

Continental.—BELGIUM.—An agreement has recently been concluded between a number of electricity undertakings in Eastern Belgium, comprised in the Groupement des Centrales Electriques de la Region de Charleroi, and several of the leading metallurgical concerns in the area whereby plant is to be installed for the utilisation of the waste gases from the ironworks for steam-raising purposes at the power stations.

PORTUGAL.—A message from Lisbon states that the Union Electrica Portuguesa is completing the installation of a thermo-electric works of 10,000 h.p. The concern hopes that it will now be able to attract large industries which were not willing to engage themselves before being sure of receiving sufficient power.—*Reuter's Trade Service* (Madrid).

ITALY.—A new 135,000-V h.p. transmission line has recently been completed and put into operation by the Società Idroelettrica Piemonte from its hydro-electric station on the Marmore at Covalou along the Aosta Valley to Turin, a distance of about 60 miles. Later the line will also be connected to the station recently completed by the company at Lys, and to the one in course of construction at Evançon. At present the line is only being used to transmit power at 75,000 V, but the higher pressure will be brought into use by the end of the present year.

Dartmouth.—LAYING OF H.P. CABLE.—W. T. Henley's Telegraph Works Co., Ltd., has laid an 11,000-V h.p. cable, 550 yards in length, across the River Dart for the supply of electricity to the district.

Darwen.—PRICE REDUCTION.—The Electricity Committee has decided to reduce the charges for electricity by 10 per cent. to all consumers with the exception of those supplied under industrial power contracts.

Fishguard.—PROPOSED ELECTRICITY SCHEME.—At a recent meeting of the Urban District Council, Mr. Parkington, of Newcastle Emlyn, promoter of the proposed local electricity scheme, presented his report. He suggested that the company to be formed should be given a tenure of 30 years, the Council to have an option of purchase at the end of 20 years. It was proposed that the charge to consumers should not exceed 10d. per kWh, and it was anticipated that as the demand for supply increased, the charge would be reduced. The minimum charge would be 15s. per annum. Three methods of supply had been considered, *viz.*, from the G.W.R. power station at the Harbour, a water-power scheme, or a power station at Fishguard. The first was the most feasible at present and could be worked quite satisfactorily. The Council decided that Mr. Parkington should prepare a final scheme for its approval before submitting the proposal to the Electricity Commissioners. It is hoped that a supply will be available by next winter.

Glasgow.—REFUSE PLANT.—The Corporation has given notice that an application has been made to the Electricity Commissioners for consent to establish at Helen Street, Govan, a generating station in connection with the refuse disposal works erected by the Corporation.

PROGRESS DURING APRIL.—Under the three-years' scheme of the Corporation Electricity Department, 75 houses were wired in April, making the total to date 3,553. Under the 10 years' hire-purchase scheme 153 houses were wired, making a total of 401. Applications for the hire of appliances numbered 146, bringing the total up to 14,895.

Greenock.—EXTENSION OF SUPPLY.—Two years ago the Corporation was granted powers to supply electricity to Inverkip, Wemyss Bay, and the intervening area, and a report has now been submitted by the engineer giving details of a scheme for carrying out this extension, which it is estimated will cost £10,000.

Hornsey.—NEW PLANT.—The Corporation has arranged for a formal gathering in connection with the extension of generating plant at the power station, on Saturday, July 16th, and Councillor Mrs. Everington will start up the new turbine.

Ilford.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £6,000 for mains, £1,295 for plant and kiosks, and £2,000 for wiring installations.

India.—RANGOON.—The Rangoon Tramways and Electric Supply Co. has now practically completed the scheme for modernising its power station at Ahlone. The last turbine installed, which will shortly be ready for trial, brings the total capacity of the station to 16,500 kW at normal rating, and it is anticipated that the generating plant will suffice to meet all demand for some years ahead. The work of raising the pressure on the feeders to 6,600 V is now practically completed, and work is now about to be undertaken to raise the pressure of the distribution mains from 150 V and 200 V to 230 V and 400 V.

Japan.—ELECTRICAL DEVELOPMENT.—The Tokio Municipal Electric Bureau has commenced work on the construction of a steam power station at Shibaura, which will be put in operation by the end of the year. The initial plant will have a capacity of 10,000 kW, which will eventually be doubled.

It is reported that the Tokio Dento K.K. has a scheme in hand for the erection of a power station at Senju with a capacity of 25,000 kW, and one at Tsurumi with a capacity of 50,000 kW.

Lancaster.—ELECTRICITY SUPPLY.—At the meeting of the Town Council on May 25th consent was given to a proposal of the Electricity Committee to spend £45.000 on changing over the system of supply in the centre of the town from d.c. to a.c., and on a new sub-station, offices, &c. The expenditure includes:—Purchase and equipment of premises in North Road for sub-station, showroom and offices, £8,000; plant and switchgear, £5,000; h.p. and l.p. feeder cables, £10,500; distributing cables, &c., £16,500; services, £5,000. It is estimated that it will take from three to five years to complete the change-over.

Littleborough.—SUPPLY TO HOUSING ESTATE.—The Electricity Committee has recommended to the Urban District Council that cables be laid immediately to the Dearnley housing estate for lighting and power and street-lighting purposes.

Liverpool.—RAILWAY SUPPLY.—Negotiations have resulted in the Liverpool Overhead Railway Co. deciding to take a supply of electricity at 520 V d.c. from the Corporation from the end of June.

Llandrindod Wells.—LOAN.—The Urban District Council has applied for sanction to a loan of £3,000 for mains, cookers, meters, &c.

Llansilin.—HYDRO-ELECTRIC SCHEME.—The new hydro-electric plant of the Llansilin Electricity Co., Ltd., was inaugurated on May 17th by Mr. Watkin Richards. At the turbine house Sir Watkin Williams Wynn started the turbine and switched on the current to the battery house in the village. At the battery house there is a stand-by plant.

Maidstone.—EXTENSION OF SUPPLY.—The Electricity Committee has recommended the Town Council, subject to obtaining the necessary powers, to extend the mains to Leeds Castle, at a cost of £4,320, the owner bearing the cost of cable, transformer, &c., on his premises, estimated to cost £1,100. The minimum revenue will be £846 a year for five years.

Maryport.—ELECTRICITY IN BULK.—The Urban District Council, after considering a proposal to take a supply of electricity in bulk from the Risehow Colliery Coking and By-Product Co., has asked the company if it will be prepared to pay half the cost of a Special Order if applied for by the Council.

Mexico.—ELECTRICAL DEVELOPMENT.—The Mexican Light and Power Co., which is a Canadian concern, has announced its intention of spending $14,000,000 on developments in Mexico.—*Reuter* (Mexico City).

Mid-Lancashire.—ELECTRICITY SUPPLY.—A meeting was held at Accrington on May 27th of representatives of various mid-Lancashire electricity authorities to consider the request of the Commissioners for returns showing the cost and the lowest price at which the various authorities could sell electricity. The returns will furnish the Commissioners with a comprehensive review of the mid-Lancashire electricity supply position.

Northern Ireland.—LURGAN (ARMAGH).—The Urban District Council has decided to install an additional 200-h.p. engine at its electricity works to meet the increasing demand for electricity.

Skipton.—PROPOSED PURCHASE OF UNDERTAKING.—At a recent meeting of the Council a letter was received from the Electrical Distribution of Yorkshire, Ltd., offering to take over the Council's electricity undertaking. The company expressed the opinion that considerable economy would be effected if arrangements could be made to cover the rural and urban districts of Skipton together. The offer included payment by the company of the reasonable costs of obtaining the necessary Order, together with the costs of the Council's original Order, meeting the loss already incurred on the Department, payment to the Council of the capital expenditure of the undertaking, less sinking fund, making an immediate reduction in the charges for electricity in the town, and the institution of an assisted wiring scheme. The Electricity Committee recommended that the Council should not entertain the company's offer, and it was decided to discuss the communication in committee.

Sudbury.—ELECTRICITY SUPPLY.—The East Anglian Electric Supply Co., Ltd., is arranging to obtain a bulk supply of electricity from Braintree, and a supply will be available in Sudbury this autumn. The company is experiencing some opposition from farmers within the area through which the mains have to pass, and it is probable that it will have to request the Ministry of Transport to hold an inquiry.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by Electricity Distribution of North Wales and District, Ltd., authorising it to supply electricity in the urban districts of Buckley, and the Wisbech Electric Light & Power Co., Ltd., to supply in the urban district of Walsoken.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them to be granted to the Urban District Council of Criccieth for the supply by the Electricity Distribution of North Wales and District, Ltd., of electricity in the urban district.

Tynemouth.—STREET LIGHTING.—The Corporation has decided to lay cables, at a cost of £1,850, for lighting by electricity the part of the coast road within the borough.

United States.—ELECTRICAL DEVELOPMENT.—According to *Electrical West*, two contracts covering four 33,333-kVA transformers and seven 25,000-kVA transformers respectively, for the Southern California Edison Co. have been placed with the Westinghouse Electric and Manufacturing Co. These units will be manufactured at the Sharon works for delivery during the coming spring and summer. The 33,333-kVA units are the largest single-phase transformers to be built from the standpoint of capacity. All of the units are to be single-phase, self-cooled, air-blast, for use on the 220-kV system of the Southern California Edison Co. They will transform the voltage from 16 kV to 220 kV. Each transformer, completely set up, weighs more than one hundred tons, and from the top of the high-voltage bushing to the ground measures 400 in. The seven 25,000-kVA transformers are for the Lighthipe sub-station and will be used to connect 220-kV and 60-kV transmission systems. They are similar in construction to the four larger units.

Tramway and Railway Notes.

Blackburn.—YEAR'S WORKING.—We have received from Mr. J. H. Cowell, general manager of the Corporation tramway undertaking, a copy of his report, together with the statement of accounts, on the working of the undertaking for the year ended March 31st last. The total revenue amounted to £106,025, as compared with £113,156 in the preceding year. Working expenses were £79,294, as against £83,667, leaving a gross profit of £26,731 (£29,489). After payment of capital charges and making contributions to the sinking and permanent-way renewals funds, there was a net surplus for the year of £10,590, as compared with £13,252 in 1925-26. A contribution of £5,000 was made to the borough fund. The number of passengers carried fell from 16,994,833 to 16,152,313, and the car-miles run from 1,128,178 to 1,084,686, the falling off being almost entirely due to the general strike.

Cardiff.—PROVISIONAL ORDER.—The Unopposed Bills Committee of the House of Commons on Thursday last week had before it for consideration a Bill to confirm a Provisional Order granted by the Ministry of Transport sanctioning various small sections of tramway construction at Cardiff. The Ministry's representative stated there were four short tramways proposed, one of which was a connecting line and the others extensions of existing systems. There had originally been two objections, but clauses had been inserted for the protection of the Cardiff Gas Co. and the Great Western Railway Co. The Order was confirmed.

Japan.—TRAMWAY SCHEMES.—It is reported that the Okayama Municipality is to establish an investigation department with a view to introducing a tramway service in the city. The cost of the first section of the scheme is estimated at 1,500,000 yen.

Negotiations are in progress for purchasing the Enoshima electric tramway from the Tokio Dento K.K. by Messrs. J. Kadono and J. Yamamoto, who intend forming a company with a capital of 5,000,000 yen for the running of the above tramway, and then increasing the capital to 7,500,000 yen by amalgamating with Enoshima Dento K.K. It is also desired to further augment the capital to 15,000,000 yen with a view to laying an electric tramway between Ofuna and Osaki.

London.—FARES.—The London County Council will, from June 1st to September 30th, issue 6d. all-day tickets for children under fourteen, which will entitle them to the same privileges as those granted by the present 1s. tickets for adults.

Manchester.—YEAR'S WORKING.—The report on the working of the Corporation tramway undertaking for the year ended March 31st last shows that the traffic revenue amounted to £1,754,252, as compared with £1,783,484 in the previous year. The gross profit amounted to £305,863, and after meeting capital charges, &c., there was a net surplus of £45,327, as compared with £116,608 in 1925-26. The number of passengers carried fell by approximately 7,000,000. The decrease in receipts, and the increased working costs are accounted for by the general strike and the coal stoppage of last year.

Southern Railway Scheme.—Work is to commence immediately on the widening of a portion of the main line of the Southern Railway between Beckenham Junction and Kent House station, including the raising and widening of two bridges. The widening of the line for about half a mile on the London side of Beckenham Junction will enable four sets of rails to be provided to Kent House, and will do away with the bottle-neck approach to the former station. When the work is completed it will be possible to run a new service of electric trains between Victoria and Beckenham Junction, *via* Clapham Junction, Balham, Gipsy Hill, and Crystal Palace, which will form a link between Beckenham and the neighbourhood and many stations on the Central and Western sections of the Southern Railway. Alterations at Beckenham Junction station will consist chiefly in lengthening the "up" bay platform by about 200 feet to enable full-length electric trains to be dealt with there. The total cost of the scheme is estimated at £100,000.

Telegraph and Telephone Notes.

India.—PHONOGRAMS IN CALCUTTA.—It is proposed to introduce in Calcutta as an experimental measure a system which will provide facilities for telephone subscribers to send and receive telegrams in plain English by telephone. The subscriber will be required to pay an additional charge of two annas only per telegram transmitted, while received telegrams will be transmitted free of charge.

South Africa.—"BEAM" RADIO-TELEGRAPHY.—Marconi's Wireless Telegraph Co., Ltd., has completed preliminary tests with South Africa with the "beam" wireless stations which it is erecting at Bodmin and Bridgwater for the General Post Office. Further tests by the company under ordinary traffic conditions will commence immediately; should they prove satisfactory, the stations will be handed over to the General Post Office for the official seven days' trial. During the tests so far made by the Marconi Company, speeds of between 200 and 250 words per minute have been maintained over long periods daily.

United States.—SHORT-WAVE ARMY COMMUNICATION.—Short-wave transmitters are being used by the Army Signal Corps to circumvent static in the transmission of official messages over the Army radio net which connects the War Department with the Corps area headquarters and Army posts throughout the country. During the severe static months at least 75 per cent. of the Army telegraph business, both day and night, from Washington was transmitted by ten of the new sets that were installed, and they worked so well that more sets have been ordered, says *T. & T. Age*. The sets are crystal controlled and designed to operate in two frequency bands, one of approximately 4,000 to 4,500, the other of 8,000 to 9,100 kilocycles.

Radio Notes.

Austria.—NEW STATION.—After months of experiment and tests, the Innsbruck station is to be officially inaugurated on June 2nd. Normally it will relay the Vienna programmes.

Canada.—NEW STATION.—It is reported that the Ontario Government will shortly undertake the erection of a 1,000-watt broadcasting station near Toronto to be used by the Department of Agriculture for broadcasting lectures, weather reports, and possibly general entertainment.—*Reuter's Trade Service.*

United States.—TRANSMISSION PROBLEMS.—Developments in broadcast transmission are announced by the Westinghouse Electric Company, which claims that a system developed at KDKA eliminates three-quarters of the transmitting valves, permits of the broadcasting of a radio wave many times sharper than has heretofore been possible, and provides the same range and quality of transmission with less than half the usually required power input. The new system is regarded as important in offering solutions to many problems, including the possibility of a reduction of station interference and an opportunity to overcome static and local interference in receiver design, whilst an immediate effect noted by operators of receivers in the vicinity of KDKA is a lifting of the blanketing effect that usually surrounds high-power stations, due to the sharpness of the radiated wave. The new system is defined as "frequency modulation," instead of the present method of "power modulation"; heretofore the frequency band required for station operation has been 10 kilocycles, but in the new system the band has been cut to one-half kilocycle. It is explained that the 10-kilocycle separation between stations will still be required with present-type radio receivers, but the new system requires such sharp tuning as to eliminate the annoying interference set up by powerful stations operating on adjacent wave bands; also in transmission, instead of varying the amplitude or strength of the signal, as is present practice, Westinghouse engineers are maintaining constant strength of signal and are varying the frequency of the transmission by an amount usually not more than from 500 to 800 cycles, which they refer to as "frequency modulation." There has been a great reduction of the number of valves and power required; all modulator valves are eliminated, which (at KDKA) means 12 of the 10-kilowatt water-cooled type. In present-day methods of broadcasting, half the total energy supplied to the transmitter is absorbed and dissipated as heat, amounting to 80,000 watts; this energy is now saved and can be made available to increase the power of the transmitter if desired. So radical is the departure from present practice that engineers hesitate to forecast the improvements likely to result from the general application of the new system.

According to *Reuter's* agency, successful experiments indicate that approximately 1,900 stations can operate in exclusive channels at one time without sharing waves or "splitting" time, and the Company claims that the system will solve the congestion problem which the Radio Commission is now attempting to deal with, and will permit the operation of 300 applicants for licences in addition to the 680 stations already licensed.

RADIO INVESTMENTS.—The United States Department of Commerce has estimated unofficially that the total investment in radio in the United States was, on January 1st, 1927, approximately, $750,000,000, which figure is the estimated aggregate of the current value of the 6,500,000 receiving sets in use, and of the investment represented by the 700 or more broadcasting stations, the 2,550 manufacturing plants, and the 30,000 dealers, says *World Radio*.

POWER REDUCTION.—The Federal Radio Commission has directed all stations to announce their call letters and location once every 15 minutes at least. It has also ordered that all stations must not deviate more than half a kilocycle from the wavelengths assigned to them. Owing to constant complaints of interference caused by broadcasting stations using too much power within residential sections of Chicago, three of them have been directed to reduce their maximum power output to 500 watts, effective at once, and to use no more until further notice.

STATION NAMES.—A very friendly reception was given by members of the Federal Radio Commission to a suggestion of the National Association of Broadcasters that radio stations be named instead of merely listed by call letters. At the same time, members suggested that such a movement might come from the broadcasters and need not alter the present plan of classifying stations for licensing and regulation. A commissioner, Mr. Caldwell, said that there was a good deal of protest against the constant repetition of a combination of letters. He saw no objection to the use of a name by a station, though of course the licence would have to contain some method of registration by letter, or number. Radio inspectors were at present continuously testing the ability of each station to stay in its assigned radio channel and the announcement of the letters helped them to keep this check, but when the re-assignment of broadcasting channels had been made and radio transmission had settled down thoroughly the call letters might be dropped almost completely and the lawfully operating station use its name.—*Reuter's Trade Service* (Washington).

Reviews.

Electro-Organic Chemistry. By C. J. BROCKMAN, Associate Professor of Chemistry, University of Georgia, U.S.A. New York: John Wiley & Sons, Inc. London: Chapman and Hall, Ltd. Pp. xi+381; figs. 15. Price 25s. net.

The object of the volume under review is to give a critical and detailed account of the present position of the study of the vast number of organic reactions which may be accomplished by electrolytic methods, and to discuss the theories on which the practice is based. This illuminating volume offers an excellent and lucid survey of recent advances in this branch of scientific thought, and it also gives its readers the means of acquiring a really sound familiarity with the fundamental principles of the subject. Intricate electro-organic reactions are discussed, recording the degree of success which has been attained and the path whose pursuit offers the most promising results in extending the practical application of the science. The book is eminently practical, inasmuch as it informs those who are actively engaged in manipulative operations how certain results are obtained. Details of recently suggested operations are included, which, if brought into commercial use, would prove time saving, economic and of real utility. The treatment of the subject is remarkably complete, copious references being made to the original literature, including patent literature. The author has drawn his references from a very wide field, but the preponderance of American references is a very noticeable feature, which, no doubt, correctly reflects the activity of United States workers on this subject during recent years. The author meets the requirements of research workers and those who desire to make a more intensive study of the principles involved by adding hitherto unpublished information, numerous references to recent investigations, together with the sources of original contributions. A treatise of this nature, coming from such an authority as Dr. Brockman, who has himself played so important a part in the development of the subject, is an invaluable addition to the literature of electro-organic chemistry. The work has entailed a great deal of time and thought in its preparation, and is perhaps the most successful attempt that has yet been made to correlate the several theories and to deal exhaustively with the problems of the subject. The author is to be congratulated on his successful achievement.

The book is divided into two parts; the first part deals with reactions at the anode, being further divided into chapters on electrolytic oxidation, and the oxidation of ionised and non-ionised substances. The second part of the volume deals with reactions at the cathode, the individual chapters dealing, respectively, with electrolytic reduction, the reduction of aromatic nitro- and nitroso-compounds, the carbonyl group

and compounds containing arsenic, chlorine, sulphur, and mercury.

The passage of an electric current through an electrolyte either deposits a metal on the cathode or evolves hydrogen. The electrolytic hydrogen may become attached to an organic compound or it may remove oxygen or both. An example of the addition of hydrogen to a molecule is found in the case of the reduction of cinnamic and nitro-cinnamic acids, respectively. The best example of the removal of oxygen and in its place the substitution of hydrogen is in the reduction of nitro benzene. In the electrolytic oxidation of organic compounds in general, the materials to be oxidised consist of the depolariser; they are also poor conductors of electricity, hence they can seldom be used without the aid of an electrolyte. Since it is difficult to regulate the electrode potential for any one reaction, it is seldom that all the oxygen is absorbed by the depolariser; that which is not absorbed will therefore be evolved at the anode as a gas. The amount of oxygen absorbed by the depolariser depends on the nature of the depolariser, the current density, diffusion of the depolariser, dimensions of the anode surface, rate of agitation, the catalytic influence of added compounds, temperature, and the composition of the anode and the solvent. These factors may be considered as primary conditions, in that during the ordinary electrolysis, without any external changes brought about by the hand of the operator, they regulate the course of the electrolysis; the conditions of the operation may, however, be so changed as to modify the results very considerably.

Perhaps one of the most stimulating chapters in the book is that dealing with the subject of electro-chemical substitution, in which is found much useful information relating to the introduction of halogens into aromatic compounds, together with substitution in acid, neutral and alkaline solutions. The chapters devoted to the reduction of aromatic nitro-compounds are also to be commended for their clarity of statement, soundness of teaching, and admirable discussions of many imperfectly explained reactions. Evidently the whole problem interests the author very keenly. The concluding chapter reviews in a series of well-reasoned comments some special methods of electrolytic reduction of organic compounds containing arsenic, chlorine, sulphur, mercury, &c. The rapid advances that are being made at present in the chlorination of petroleum and the separation of the chlorinated products will probably lead to an entirely new group of intermediate compounds. With the development of new methods of preparation, commercial production may be in a position to accept electro-chemical methods for the treatment of some of these compounds; besides being valuable as solvents, these chlorinated compounds are also of use as intermediates in several industries.

The whole work is admirably condensed, modern aspects are included, and throughout the author has striven to explain intricate reactions in the simplest possible language. The book is replete with indications of probable lines of advance, and in this respect will make an appeal not only to the theorist, but also to the experimental worker. The volume is excellently paragraphed, written in a good literary style, is commendably free from inaccuracies, and is a valuable work of reference in both the theoretical and technical aspects of electro-organic chemistry. A comprehensive authors' and subject index is provided. The volume cannot fail to be of value to all organic chemists employed either in academic work or industry. The reader—like Jonathan in the day of battle, having tasted the wild honey in the wood—will find his eyes enlightened, and will pursue his studies in this wide branch of organic chemistry with added zest and pleasure.

Electric Switch and Controlling Gear. By C. C. GARRARD, Ph.D., M.I.E.E., A.Am.I.E.E. Pp. xiv + 783; figs. 649. London: Ernest Benn, Ltd. Price 63s. net.

The massive volume under notice is the third edition of Dr. Garrard's well-known book, which was originally introduced to the public in 1916, and which has now been revised and considerably enlarged in the process of being brought up-to-date by the inclusion of accounts of appliances and methods evolved since the original publication of the work. The general plan of the book remains unaltered, the numerous appliances described being grouped according to the functions they are designed to perform. Following a preliminary chapter dealing with materials, manufacturing methods and specifications, we find that appliances for breaking electric currents, such as switches, fuses and circuit breakers, are fully considered. The discussion of circuit breakers naturally leads to a consideration of means for the prevention of abnormal currents in circuits by the use of protective relays and other methods. In the new edition the work dealing with this branch of the subject has been enlarged by the inclusion of a considerable amount of matter concerning the biased systems of protection which have recently attracted attention. Chapters IV and V are devoted to a consideration of starting and regulating appliances, and these are followed by chapters dealing with the assembly of appliances for the formation of complete switchboards. A feature of the section dealing with switchboards is the consideration given to the circuit arrangements necessary for the control of the various types of machines, and we find that not only is due attention paid to the more common machines such as rotary convertors and balancers, but also to the less common appliances, such as phase advancers and rectifiers. The concluding chapter is concerned with appliances and methods for the protection of machines and circuits against abnormal conditions giving rise to excessive pressure. The book terminates with ten appendices concerned with the regulations issued by various controlling authorities so far as they relate to switchgear.

It would appear that a book on switchgear would be more difficult to successfully produce than one relating to almost any other branch of electrical engineering, since, on account of the number and variety of the appliances falling within its province, there must always be a great difficulty in preventing the text resolving itself into a mere description of the various pieces of apparatus concerned. Probably no one is better fitted to undertake the task than Dr. Garrard, who is able to draw upon his very large experience on both the technical and commercial sides of the subject in order to link together the descriptive parts of the book with useful and pertinent discussions concerning the principles involved. Thus, in the work before us, we find, for example, that the descriptions of the various appliances for the starting of squirrel-cage induction motors are accompanied by a very useful discussion, based on the scientific principles involved, of the relative merits of the several methods, and again, when dealing with protective systems, the degree of sensitiveness of each system is considered together with the reasons leading thereto.

The book is well printed, few errors being apparent, though one occurs in a prominent place on the loose cover, and the illustrations, both line and half-tone, are well chosen and reproduced.

The size and quality of the book have unfortunately resulted in a high price which we fear will tend to put it out of the reach of many students and junior engineers, and this is to be regretted since Dr. Garrard has done his work well and produced a book which is full of live and vital matters from beginning to end. It is likely to be a standard work of reference for many years to come.

The Director System of Automatic Telephony. By W. E. HUDSON, B.Sc. (Hon.), Whit. Sch., A.C.G.I. Pp. xii+ 157; figs. 73. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

This further contribution to the steadily growing literature on the subject of automatic telephony is designed for the use of linesmen, traffic officers, and telephone engineers, to enable them to obtain a knowledge of the system adopted by the British Post Office and now being introduced into certain of the larger towns. The author, who is a post office official, may therefore be assumed to write from practical experience of the system. The object of the book is to show how the principles of "step-by-step" selection are amplified to meet the requirements of large multi-exchange areas, in addition to which brief descriptions are given of the special facilities required for dealing with automatic-manual and manual-automatic traffic during the change-over period. In order to simplify the usually complex circuit diagrams the author adopts the "circuit element" drawing, in which "the contacts are separated from the relay coils and gathered up into a number of circuit elements, each element having one or more functions in the circuit operation." The advantage of this method is apparent when dealing with circuits having a large number of functions. The last two chapters of the book are devoted to "metering," and illustrations of exchange apparatus. Although the subject has been very greatly condensed, the book will prove a useful guide to those who are interested in the subject of the "Director" system of automatic telephony.

Données Numériques d'Electricité Magnetisme et Electrochimie. Edited by an International Committee. Pp. 1 + 143. London: Cambridge University Press. Price 77 fr. (bound), 56 fr. (stitched).

This is an extract from Vol. V of the "Tables Annuelles de Constantes et Données Numériques," and gives the data for the years 1917 to 1922 inclusive. It has a preface by Mr. G. Semenza, president of the International Electrotechnical Commission, who expresses the relief that the reader of a research feels nowadays when he is able to ascertain at once the very latest values that have been assigned for physical and chemical constants—contrasted with the uncertainty that so often hampered progress before these data were thus authoritatively brought together. Only by an international organisation could this end be achieved.

Without a collection of this kind the investigator could not possibly ascertain the state of knowledge of the subject in which he was interested, and consequently a great deal of overlapping would be inevitable. By cutting out this waste to a great extent, the work materially hastens progress; moreover, as Mr. Semenza remarks, it stimulates imagination and suggests new directions for exploration.

To review its contents is impossible; to commend them as indispensable to the research library is a duty, for they undoubtedly render valuable service to the scientific world.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically-operated overhead travelling crane. (A.X. 4727.)*
SYDNEY.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*
August 15th. Generator neutral earthing resistance. B.X. 3550.)*

Barton-on-Irwell.—June 7th. Barton and Urmston Joint Electricity Board. Static transformer sub-station, plant and cables. Specifications from Mr. J. A. Robertson, consulting engineer, 20, Brazennose Street, Manchester.

Dublin.—June 8th. Port and Docks Board. Two 200-yd. lengths of 0.4 sq. in. single, lead-covered, armoured, submarine cable, 660-V quality, in accordance with B.E.S. specification No. 7-1926.

Greenock.—June 17th. Corporation. Supply and erection of 11,000-V overhead transmission line and transformers. (See this issue.)

Hull.—June 16th. Electricity Department. Steel coal bunker and conveyor housing. (May 20th.)
Switchgear extensions. (May 27th.)

London.—STEPNEY.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (See this issue.)
H.M. OFFICE OF WORKS. June 13th. Fuseboards and fuses. (See this issue.)

Manchester.—June 13th. Electricity Department. Seven 250-kVA static transformers. Mr. H. C. Lamb, chief engineer and manager, Town Hall, Manchester.

Marlborough. — Electricity Department. Additional underground feeder and overhead feeder. (May 27th.)

New Zealand.—WELLINGTON.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings. (B.X. 3533.)*

Nottingham. — June 21st. Electricity Department. General stores for 12 months. (See this issue.)

Oldham.—June 11th. Electricity Department. Water-cooling towers, foundations, tanks, and circulating water pipes. (May 27th.)

Portsmouth. — Electricity Department. Transformers. (May 27th.)

Pudsey.—June 14th. Electric lighting installation at the School of Art. Specification from Education Department, County Hall, Wakefield.

Sheffield.—June 11th. Tramways and Motors Committee. Supply and erection of weighbridge. Mr. A. R. Fearnley, general manager, Division Street, Sheffield.

South Africa.—CAPE TOWN.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

ELLIOTT (C.P.).—June 15th. Municipal Council. Electric lighting plant, including engines and dynamos, steel poles, copper wire, insulators, switchboard meters, house-service fuses and street-lighting brackets and suspension fittings.
EDENBURG (O.F.S.).—June 21st. Municipal Council. Electric lighting plant, including engines, dynamos, steel poles, &c.—*S.A. Mining and Engineering Journal.*

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aberdeen.—Housing Committee.
Installation of electric lighting at the new houses (1,000) at Cattofield and Hilton.—Andrew M'Robb.

Australia.—MELBOURNE.—State Electricity Commission of Victoria.
H.p. water-tube boiler and accessory plant (£17,383).—Babcock & Wilcox, Ltd. —*Tenders.*

Barking Town.—Electricity Committee. Recommended: Erection of showrooms and offices in Ripple Road (£4,580).—H. Newell.

Birmingham.—Education Committee. Accepted:—
Electric lighting installation, Sladewell Road school.—S. R. Hare.

Electricity Committee. Accepted:—
Laying cable between Summer Lane generating station and Halesowen.—British Insulated Cables, Ltd.
Switchgear for various sub-stations.—General Electric Co., Ltd.

Bromley (Kent).—Education Committee. Accepted:—
Installing electric lighting at Burnt Ash school (£804, including a provisional sum of £250 for fittings and fixtures).—R. E. Knight.

Erith.—Urban Council. Accepted:—
Joint boxes (£549).—Callender's Cable and Construction Co., Ltd.
Switchgear (£319).—Johnson & Phillips, Ltd.

Glasgow.—Corporation. Accepted:—
Renewal of the main switchboard of the Pollokshaws Burgh Hall (£90).—W. Draper & Co.

Guildford.—Electricity Committee.
Three-phase switchboard:—

New Switchgear Construction Co., Ltd.	(Accepted)	**£760**
Crompton & Co., Ltd.		886
General Electric Co., Ltd.		898
English Electric Co., Ltd.		895
Ferguson, Pailin, Ltd.		906
Metropolitan-Vickers Electrical Co., Ltd. ...		908
British Thomson-Houston Co., Ltd.		948
A. Reyrolle & Co., Ltd.		967
Johnson & Phillips, Ltd.		1,010

Direct-current switch panels (£970).—Crompton & Co., Ltd.

Underground cables:—

Standard Telephones & Cables, Ltd.	(Accepted)	**£3,246**
W. T. Glover & Co., Ltd.		3,291
W. T. Henley's Telegraph Works Co., Ltd. ...		3,294
British Insulated Cables, Ltd.		3,304
Callenders Cable & Construction Co., Ltd. ...		3,344
Johnson & Phillips, Ltd.		3,365

Housing Committee.
Wiring 60 flats at Aldershot Road for electricity:—

Electrical Installations, Ltd. (Accepted) ...		**£294**
Bowden & Higlett, Ltd.		312
A. Meckonik		404

Government Contracts.—GENERAL POST OFFICE.—*Correction.*—We are informed by Messrs. Siemens Bros. & Co., Ltd., that they were awarded the contract for telephone exchange equipment for the head office and estate office of Messrs. Harrods, Ltd., and not the Relay Automatic Telephone Co., Ltd., as stated in our last issue. Our information was derived from the *Ministry of Labour Gazette.*

Grays.—Urban Council. Accepted:—
Rotary convertor, &c.—Crompton & Co., Ltd.

Hull.—Telephones Committee. Accepted:—
Cords.—L.P.S. Electrical Co., Ltd.

Health Committee. Accepted:—
Electrical equipment for radiant heat at vapour and electrical baths (£245).—Cox-Cavendish Electrical Co., Ltd.

Ilford.—Town Council. Accepted:—
1,500-kW motor-convertor (£4,306).—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear (£1,470).—General Electric Co., Ltd.

Electricity Committee. Recommended:—
Switchgear for Ley Street works (£1,470).—General Electric Co., Ltd.
Joint boxes.—W. T. Henley's Telegraph Works Co., Ltd.
Lamps and house boxes.—W. Lucy & Co., Ltd.

Irish Free State.—DUBLIN.—Controller of Stores (Posts and Telegraphs).
Cases for switchboards.—Scott & Co.
Positive plates.—Hart Accumulator Co., Ltd.
Lead sleeves.—Farmiloe & Sons.
Zinc rods and zinc strip.—London Zinc Mills, Ltd.
—*Irish Electrician.*

Kendal.—Board of Guardians. Accepted:—
Electric lighting at the Institution (£225).—R. Hadwin and Son.

London.—BATTERSEA.—Town Hall Committee. Recommended:—
Electric organ-blowing plant for Town Hall organ (£160).—William Hill & Son and Norman & Beard, Ltd.

METROPOLITAN WATER BOARD.—Accepted:—
Electrical fittings for Green Lanes pumping station; electric lighting conduit at Kempton Park station.—General Electric Co., Ltd.

METROPOLITAN ASYLUMS BOARD.—Works Committee.
Installation of electric power in laundry, &c.:—

T. Clarke & Co., Ltd. (Recommended.) ...	**£386**
Burdette & Co., Ltd.	433
E. Wendey	444
Douglas Electric Lighting & Power Co. ...	444
Smith & Hammond, Ltd.	447
Electracts, Ltd.	520
Alternative	573

Manchester.—Tramways Committee. Accepted:—
Trolley wire.—R. Johnson & Nephew, Ltd.
Tramway rail bonds.—Forest City Electric Co., Ltd.
Electricity Committee. Accepted:—
Replacement of 33,000-V cables and trifurcating boxes for the Barton house service transformers.—Pirelli-General Cable Works, Ltd.
Housing Committee. Accepted:—
Electric lighting of houses on various estates.—S. Dickinson and W. Spreadborough; Hanchett, Barratt and Currie.
Tramways Committee. Accepted:—
Maximum traction trucks.—Brush Electrical Engineering Co., Ltd.
Tramcar motors and controllers.—British Thomson-Houston Co., Ltd.
Tramcar motors.—General Electric Co., Ltd.
Tramway poles.—British Mannesmann Tube Co., Ltd.
Span wire brackets.—John Spencer, Ltd.
Steel girder tram rails.—Cargo Fleet Iron Co., Ltd.; Bolckow, Vaughan & Co., Ltd.

Salford.—Watch Committee. Recommended:—
Electric light installations at 16 firemen's dwellings at central station (£169).—Height Engineering Co.
Health Committee. Recommended:—
Electric light installation at Drinkwater Park hospital (£163).—Taylor & Son.

Seaham Harbour.—Housing Committee. Recommended:
Wiring 80 cottages for electricity (£266).—C. Doyle (Newcastle).

Stoke-on-Trent.—Electricity Committee. Accepted:—
Distributor wiring at the Abbey Hulton housing site (£327).—Barnett & Soans; Acres Wood housing site (£187).—Hawley & Ingram; and Tarleton Road housing site (£185).—Blackburn, Starling & Co., Ltd.
Housing Committee. Accepted:—
Electric wiring in houses on the Northwood Park estate (£447).—Tomlins, Ltd.

Forthcoming Events.

Optical Society.—Thursday, June 9th. Imperial College of Science, South Kensington, S.W. 7.30 p.m. Paper, "The Use of Photo-Electric Cells for Precision Photometry of Electric Lamps." Mr. T. H. Harrison.

Physical Society.—Friday, June 10th. Imperial College of Science, S. Kensington, S.W. 5 p.m. Ordinary meeting.

Heat Engine Trials Committee.—Friday, June 10th. Institution of Civil Engineers. 6 p.m. Discussion on the Report of the Special Committee on the results of Heat Engine Trials.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the name and address of makers of the following:—

Filaments for NERNST lamps.
230-volt lamps (believed imported) which are no larger than a motor-car headlight bulb.
BELMAPHONE electric buzzer.

We also have an inquiry for the present address of Messrs. William Pemberton & Sons, late of Imperial Buildings, Birmingham.

Notes.

An Important Committee Appointed.

At the moment of going to press we are informed that the Electricity Commissioners, in pursuance of the provisions of Sub-section 3 of Section 48 of the Electricity (Supply) Act, 1926, and after consultation with associations representing local authorities who are authorised undertakers, contractors, and persons engaged in the business of making and selling electrical fittings, have appointed the following to be a committee to determine any question which may be raised under Section 48 of the Act as to the recognised retail or trade prices of any electrical fittings and to advise and assist the persons concerned as to the method of giving effect to the provisions of the Section:—Mr. D. N. Dunlop, Chairman. Messrs. R. W. L. Phillips, A. Nichols Moore, S. E. Fedden, F. W. Purse, Councillor J. Moore, and Mr. A. C. Cramb, representing the Incorporated Municipal Electrical Association. Messrs. H. H. Berry and J. S. Ramsden, representing the British Electrical & Allied Manufacturers' Association. Mr. F. Winstanley, representing the Electric Light Fixtures Association. Mr. F. J. Collis, representing the Electrical Accessories Manufacturers' Association. Mr. C. W. Sully, representing the Electric Lamp Manufacturers' Association. Mr. W. F. Bishop, representing the Cable Makers' Association. Messrs. A. G. Beaver and G. Donovan, representing the Electrical Wholesalers' Federation. Messrs. H. J. Miles, T. E. Alger, H. Marryat, and L. C. Penwill, representing the Electrical Contractors' Association. Messrs. J. Allen and W. Finlay, representing the Electrical Contractors' Association of Scotland.

Electricity Supply in Ayrshire.

The members of the Ayrshire Electricity Board recently made an official inspection of their undertaking. In recent years there has been remarkable development in electricity production and distribution throughout the area, the output at Kilmarnock being upwards of 40 million kWh per annum; there are 204 sub-stations and 121 miles of overhead transmission lines. At a dinner in connection with the inspection, Mr. W. C. Bexon, the engineer, said he did not think the Ayrshire Electricity Board need worry unduly about the operations of the Central Electricity Board. The Central Board estimated that in 1932-34, by linking up, it would save on the whole a yearly sum of £175,603, of which £54,627 would be a saving to Glasgow Corporation and the Clyde Valley Company, £45,756 a saving to Edinburgh Corporation, and £100,000 a saving to the West of Scotland belt, with the remainder to the other undertakings involved. He could not quite agree with the Central Board with respect to this point. To spend five millions in order to effect a saving of £175,000 a year did not appear to him to be altogether right, especially when half of the capital would be spent on changing the frequency from 25 to 50 cycles. He did not see how the Ayrshire Board would get any benefit from that. The Ayrshire Board, in 1932-34, was going to save £17,500, which was equivalent to .07d. per unit. On the basis of the present figures he did not see how the Central Board could close the station of the Ayrshire Board at Kilmarnock.

Fatalities.

On May 26th, William Yates, aged nine years, of Bargoed, climbed a mast conveying the cables from Bargoed power station to Taff Merthyr, and came into contact with the cables. He received a fatal shock at 11,000 V.

On May 24th, Mrs. Violet Rainford receiver a fatal shock. At the inquest it was stated that she was holding a reading lamp, the flex of which was defective; there was also a fault in the wireless headphones she was wearing at the time arising from the fraying of flexibles, and Mrs. Rainford was wearing steel-rimmed spectacles. The coroner's verdict was "that Mrs. Rainford died from an electric shock caused by the passing through her of a current, and that it was due to a defective flexible of the lamp standard and defectively wired wireless headphones." We refer to this fatality in our leading columns to day.

B.E.S.A. Publication.

The British Engineering Standards Association has recently issued a B.S.S. (No. 134-1927) for iron or steel tubular poles for telegraph and telephone purposes. It deals in a very complete manner with the full details of the construction of iron and steel telegraph poles, four types of which are recognised as standard, as follows: Type A, tapered tubular pole in two or three parts; type B, riveted (seam) tapered pole in multiple sections; type C, one- or two-piece pole in reduced parallel steps; and type D, multiple-section pole in parallel steps. Perhaps the most useful feature of the specification, apart from the constructional details, is the list of standard lengths and test loads, these being common to all four types of pole. Inasmuch as the overall lengths necessarily vary slightly according to the type of construction employed, a number of nominal overall lengths have been adopted as the basis of comparison between the various types. These range from 18 to 44 ft., and the crippling loads range from 300 to 2,200 lb. applied 6 inches from the top of the pole. The general clauses of the specification explain the assumptions

regarding ground-resistance which have been made for the purposes of calculating the test weights. A schedule of mechanical properties of and calculated stresses in the materials is given, followed by clauses dealing with the means to be employed for protecting the component parts of the poles from corrosion. The sectional clauses give full details of the methods of testing the poles and their bases, if any, together with very complete drawings and tables of dimensions of the component parts of the poles and of the accessories used with the poles. The specification is bound in cloth, and copies may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 10s. 6d., post free 11s. 0d.

Floodlighting Handbook.

A recent publication of the E.L.M.A. Lighting Service Bureau, London (Electric Illumination Bulletin, Handbook No. 6, "Floodlighting"), is the result of a large number of tests and investigations which have been carried out in order to obtain data on the subject, and includes much useful information of a practical character concerning the planning of floodlight installations. It is shown that the beam from a parabolic reflector in practice is always somewhat divergent, due to the dimensions of the light source. The beam spread from the built-up mirrors with which many floodlight units are equipped nowadays is considerably greater than that obtained from a plain parabolic mirror, and it should be borne in mind that the spread is obtained at the expense of beam intensity, so that the use of mirror units is almost entirely confined to short-range projection. A method of obtaining definite asymmetrical distribution of light is outlined and involves the use of a "spreading glass," consisting of a sheet of clear glass ribbed on one side, the light being spread outward at right angles to the ribs. The various methods by which streakiness on the lighted surface, which usually results from the plain parabolic mirror, is avoided, are given. These include the use of diffusing mirrors, diffusing glass fronts, sectional mirrors, and white lamps. The beam spread from the plain parabolic mirror has been found to be 32 deg., from the diffusing parabolic mirror, 44 deg., and from the plain parabolic type with a diffusing front, 46 deg., in each case the fitting being equipped with a 250-W floodlight lamp. The co-efficient of utilisation is defined, among other characteristics of commercial floodlights, and this varies from 25-30 per cent. for the shallow parabolic plain mirror to 55-60 per cent. for the ribbed-mirror square-pattern flood lantern. Some interesting information on the constructional design of units is given, and the applications of floodlighting are dealt with at considerable length. The latter section of the work is particularly well illustrated.

The Ontario Hydro-Electric Power Commission.

The ninth annual report of the Hydro-Electric Power Commission of Ontario, which was presented to the Provincial Legislature recently, states that the financial results of operation during the year were very satisfactory. The Commission increased its power development from 808,398 h.p. to 928,032 h.p. The revenue from consumers reached a total of $20,555,179, which was sufficient to meet fixed charges, provide $4,295,894 for sinking funds, &c., and leave a surplus of $565,413. The report showed a notable increase in the number of rural transmission lines, 750 miles having been added during the year. The total rural mileage is now 2,300. The number of rural customers reached is 19,000, and the investment in rural lines totals $4,750,000, the revenue from this source being $743,133. The total of the public investment in the system amounted to $203,442,759, of which $155,769,665 is invested in the Niagara Falls System. The increase in power during the year occurred almost entirely in that system, which had 800,000 h.p. of plant in comparison with 683,646 h.p. last year. The total reserves held by the Commission for sinking fund, contingencies, &c., are $24,751,411, this fund having increased rapidly during recent years. Regarding the question of the future power supply for the eastern district, the report stated that plans were under consideration for supplying large blocks of 60-cycle power from the supply to be obtained under the contract entered into with the Gatineau Power Company for 260,000 h.p.

A Rural Electrification Scheme.

An interesting example of a rural electrification scheme is to be found in the installation recently completed at Preesall, near Lancaster. The United Alkali Company has established works on the outskirts of the village, and it is from the power house of those works that a bulk supply is provided by the company at 550 V, 50 cycles, 3-phase, through the medium of a kiosk-type sub-station. This contains two 50-kVA transformers which step up the pressure to 6,600 V, at which the supply is transmitted to the village, where it is received by two 50-kVA kiosk sub-stations for reducing the pressure to 416/240 V for distribution. The l.p. distribution system extends as far as Preesall Park on the south, and interconnects between the kiosk sub-station at Preesall and the one at Knott End, and finally terminates at the extreme limit of Knott End, including the Ferry Slip. The main distributors are sub-controlled by means of feeder pillars, one at Preesall and the other at Knott End, where the local distribution is split up. In addition to over 250 consumers who have already been connected to the mains, some 60 public street lamps are supplied from the system. These are connected directly to the local distributors, and each is controlled by means of a time switch. The system of charging is on a flat rate of 10d. per kWh for lighting and 2d. for power and heating. During the quarter ended September 30th, out of 18,000 kWh which were sold 14,300 kWh were for power and heating. The Preesall Council hires out electrical domestic appliances of all types, and it has at present about 30 electric cookers and 50 wash boilers connected to the mains. Several of the local farmers are using power for milk separating and other small-power requirements about the farm, and poultry farmers are also adopting the use of electricity in their cabins to increase the production of eggs. A special rate is charged for electricity for this purpose, provided it is used during certain restricted hours. The principal power consumer is the local flour mill, which has been converted from windmill operation to the electric drive. Three motors have been installed, totalling 45 h.p., and a special arrangement has been made to ensure that the supply will not be taken during periods of maximum peak loads. The contract for the complete scheme was placed with the Pirelli-General Cable Works, one of the associated undertakings of the General Electric Co., Ltd., by which the switchgear and transformer equipment was supplied.

Novel Electric Vehicles.

Our recent note on the subject of electric battery-driven street-lighting tower wagons (April 1st issue, page 523) has prompted Messrs. Electromobile, Ltd., to draw our attention to the fact that their associated company in America has built

A Street-lighting Tower Wagon.

a number of this type of vehicle, which can be supplied in this country when required. The accompanying illustration depicts such a wagon in the service of the Philadelphia Electric Co., U.S.A.

Appointments Vacant.

Assistant master in the Electrical Engineering and Physics Department of the L.C.C. School of Engineering and Navigation, Poplar, for the L.C.C. Permanent-way foreman for the Dundee Corporation tramways. Inspector of works (£6) for the Tilbury U.D.C. electricity scheme. Clerk of works (84s.) for the Llanfairfechan U.D.C. electricity scheme. Meter repairer for the Stepney Borough Council Electricity Department. Commercial assistant for the Borough of Colchester Electricity Department. Lecturer in electrical machinery for the L.C.C. Hackney Institute. (See our advertisement pages to-day.)

Electrical Development in Germany.

According to the report for 1926 of the Union of Electricity Works, the total capacity of the German works amounted to 5,700,000 kW, as compared with 5,000,000 kW for the previous year. The running of the works was normal, although sales of electricity for power purposes suffered considerably from the depression in industry. Only in the last months of the year did industrial consumption of power begin gradually to increase, and there was a rise in output from 11,700,000,000 kWh in 1925 to 12,100,000,000 kWh in 1926, or about 4 per cent. Contrary to industrial sales the use of electricity in homes increased considerably, and was large enough in many places to make up for the falling off in sales to industries.—*Reuter's Trade Service* (Essen).

Electrodeposition for Rust Protection.

At a meeting of the Electroplaters' and Depositors' Technical Society, which was held at the Northampton Polytechnic Institute on May 18th, Mr. S. Wernick, B.Sc., read a paper on "The Protective Effect of Metal Deposits on Iron." He said that the three important factors which concerned electrodeposition for rust protection were the nature of the protective metal, the thickness and condition of the deposit, and the conditions under which it had been deposited. So far as the first two points went, a useful guide was found in applying Nernst's solution pressure theory and the normal potentials of the metals commonly deposited. The same theory gave a good picture of the mechanism of the rusting of iron. Theoretically, of the metals which had been deposited, only zinc, chromium and possibly cadmium could be expected by acting anodically to the iron to act as rust preventives. The conditions of deposition were, however, extremely important factors: such factors as the preliminary treatment, porosity of the base metal, structure of the deposit, type of solution used, throwing power of the solution, mode of handling, and the final finish, all entered into the production of an efficient deposit. The throwing power of a solution was particularly important in the case of articles with sharp bends or deep recesses. This fact, together with the fine structure obtainable from cyanide solutions, accounted for the marked superiority of these baths over acid sulphate solutions in the case for example of zinc.

Electrolytic zinc was superior to zinc deposited in any other way on account of its great purity. Nickel could act as an efficient protector provided its thickness was at least 0.001 inch. Cobalt had given very good results with a copper underlay and had stood up better than a copper-nickel deposit. Cadmium was certainly comparable with zinc as a rust preventive. Chromium gave varying results mainly of a disappointing character—probably due to its proneness to passivity; a copper-nickel underlay gave improved results. In conclusion, he stressed the need for a standard corrosion test which should be laid down to render the results of different investigators comparable.

Phototelegraphy.

Photographs sent by radio are enlarged to nine times their original size by means of new receiving apparatus tested successfully by the Radio Corporation of America, according to the *T. & T. Age*, which explains that the paper used for receiving the pictures was made especially for the purpose. The actual enlarging is done by a small asbestos device attached to a rubber tube, through which hot air is constantly blown; a tiny opening at the end of the tube lets hot air blow on the paper, making a black mark. The pictures are made, however, by a second tube conveying cold air, the passage of which to the paper is controlled by radio signals; if the cold air passes in front of the current of hot air, it prevents the hot current from making a mark on the paper. Thus there is obtained the succession of black dots and lines and white spaces, which, when seen together, make the picture. The receiving marker moves across three times as far and up and down three times as far as in the original photograph

Electric Smelting in Sweden.

A preliminary statement was recently made before the Varmland Mining Association concerning the trials which have been made at the Uddeholm works with the so-called Flodinska method of producing steel from ore briquettes. Since promising results were obtained in a small experimental furnace of from 200 to 300 kW, a furnace of from 1,500 to 2,000 kW has been constructed at Hagfors. This was in operation for an uninterrupted period of five weeks, and during this period a total of 395.7 tons of steel was produced from 921 tons of briquettes. The consumption of briquettes was high, but it has to be considered that the briquettes contain ore besides the requisite quantity of coal and limestone. The consumption of energy was about 2,700 kWh per ton, which is regarded as being low, as for electric pig iron the consumption is from 2,400 to 2,600 kWh. The consumption of electrodes averaged 11.6 kg. per ton, as compared with 6-7 kg. in the case of pig iron, but it is reckoned that the former rate is reducible. The analysis of the steel made was quite satisfactory; the material was rolled for various purposes, and rolled and cold-drawn tubes were also made from it. It would have been possible to keep the furnace in activity for a longer period than five weeks, but it had to be stopped on account of a scarcity of briquettes.

The Raxalp Cable Railway.

The electrically-operated suspended cable railway recently constructed to the summit of the Raxalp mountain in Austria opens up one of the most beautiful pleasure resorts in the neighbourhood of Vienna. In 1925 the Vienna Building Credit Bank approved of a scheme submitted by the Adolf Bleichert Co., of Leipzig, Germany, for the use of the system patented by Herr Ing. Zuegg, of Meran. The manufacture of the cables and the bulk of the material for the line was, however, entrusted to Austrian firms. The line is 1.34 miles in length, the difference in altitude between the lower and upper stations being 3,339 ft.; the valley station is 1,731 ft. above sea level and the summit 5,070 ft. Five cable supports have been provided, the first, fourth, and fifth being of the "gate" type, and the second and third ordinary towers, over 98 ft. high. The cable spans between supports, from the valley upwards, are, respectively, 656 ft., 1,968 ft., 2,624 ft., and 1,408 ft.; the final span is a short one, and tended to allow the cable to approach the upper station in an almost horizontal position. The average gradient of the line is 46.6 per cent., or nearly 1 in 2. The two cables are 50 mm. (approximately 2 in.) in diameter, and the total length of 7,216 ft. weighs approximately 25 tons. Each car has accommodation for 27 passengers, the line being operated in pendulum fashion with two ascending and two descending cars. The tension applied by means of heavy ferro-concrete blocks at the lower ends of the cables is one of the features of the system, reducing the number of supporting towers. The travel of the cars is effected by a 25-mm. haulage cable operated by electrically-driven winding gear at the summit station. In addition, there is a counter (ballast) cable and an auxiliary cable by means of which a small car can be run for emergency purposes. The cars are in telephone communication with both stations during their journey, and three independent brakes are provided. The cars are electrically lighted by means of accumulators, provision for charging which is made at the upper station. The normal speed of the cars ranges from 11 to a little over 13 ft. per second, so that the journey is completed in from 9 to 10 minutes. The operating plant at the summit station, which was supplied by the "Elin" Gesellschaft für Elektrische Industrie, of Vienna, comprises two 70-h.p. Diesel engines, only one of which is used at a time, the belt pulley between the two, which drives a 60-kW generator, being provided with a double clutch so that the dynamo can be connected up to either engine. Two motors operate the haulage cable, a main one of a continuous capacity of 64 h.p. and an emergency motor designed for a continuous output of 22 h.p.; a "buffer" plant, which includes a small generator and a 60-cell 370-amp.-hour battery of accumulators, not only takes up any excess of power on the downward journey, but also provides a reserve supply for the motors, and enables the engines to be run at a constant speed. There is also a small d.c. 110-V dynamo for various auxiliary purposes, while for lighting a 5-kW crude-oil engine and d.c. dynamo are also available. Many constructional difficulties had to be overcome, but the actual work of building the cable railway was carried through within twelve months.

Educational.

LOUGHBOROUGH COLLEGE.—British Empire scholarships in the Faculty of Engineering, Loughborough College, which are tenable at Loughborough for the full period of the diploma course, have been awarded by the governors for 1927 as follows: G. Macleod (Stockport); W. H. Medcalf (Woodbridge), T. Marash (Scots' College, Galilee), J. le P. Webb (Cheltenham), R. G. Martin (Wyggeston), G. L. Ryan and F. Laurence (Loughborough Junior College). These scholarships are open to all British subjects resident in any part of the Empire, and are of the value of £75 per annum.

MANCHESTER.—We have received the prospectus of the Municipal College of Technology for the summer evening classes, 1927. The classes, which will embody short courses of lectures and laboratory work, including electrical and mechanical engineering, will begin on Monday and Tuesday, June 13th and 14th.

Colour Lighting.

On May 24th members of the Junior Institution of Engineers attended a lecture and demonstration on colour lighting and its application to the stage, theatre, kinema, and so on, in the miniature theatre attached to the showrooms of Messrs. Holophane, Ltd. Mr. Gillespie Williams, the lecturer, demonstrated the effects which can be produced by the "Duo-Phantom" apparatus, ELECTRICAL REVIEW, May 6th, 1927, p. 735, a recent Holophane production.

Volta Centenary Exhibition.

The King of Italy opened, on May 28th, an electrical exhibition at Como in commemoration of the centenary of the death of Alessandro Volta, the Italian scientist who evolved the Voltaic Pile, one of the most momentous contributions ever made to the technique of generating electricity. The exhibition is being held in the picturesque Villa Olmo at Como, and will continue until October. An international Telegraph and Telephone Congress will take place during the period of the exhibition. One of the most interesting contributions to the display of electrical devices is made by Senatore Marconi, who has loaned a valuable collection of apparatus, some of which was used in his earliest experiments in 1895, together with a number of transmitting and receiving instruments which were used in the early days of commercial wireless before the development of the thermionic valve. The Marconi Company is exhibiting a collection of photographs illustrating the evolution of wireless apparatus and wireless telegraph stations, together with a collection of modern wireless apparatus.

Association of Teachers in Technical Institutions.

The annual conference of this Association is to be held at Plymouth from June 4th to June 7th. It will be opened officially on Monday, June 6th, with a civic welcome by the Mayor of Plymouth. On the same day Mr. H. Hall will deliver his presidential address.

The New Carlisle Station.

The new generating station at Carlisle, which has been constructed at a cost of £230,000, was officially opened on Thursday last week by the mayor, Mr. Archibald Creighton. The Willow Holme station, which was described in our last issue, has been constructed with a view to supplying an area of twenty to thirty miles beyond the city's boundaries. The River Eden, which was Carlisle's protection in the days of the Border raids, is now one of its chief assets in the supply of electricity. Its minimum summer flow is 10 million gallons per hour, and the station's present need is 600,000 gal. per hour. The ceremony was attended by a large number of citizens and local manufacturers, and also representatives from the rural areas. At a celebration luncheon after the ceremony, Sir John Snell, chairman, Electricity Commissioners, the chief guest, said the Government had taken a particular interest in the Carlisle scheme, and if he might have the courage or audacity, he would hazard a suggestion as to Carlisle's possible future under the new Electricity (Supply) Act. The Commissioners had lost no time in surveying the country; they had already surveyed the industrial districts of Lancashire and Yorkshire, and Cumberland and Westmorland; a scheme for Central Scotland had already been published, and one for Central England was nearly ready for publication. The geographical position of Carlisle would hardly warrant the construction of a main arterial line to connect it with other systems. But, supposing that the L.M. & S. Railway Company determined, because of the heavy gradients with which it had to deal, to electrify its system, say from Derby and Preston on the south and Glasgow on the north, then, there would be a reason for an arterial line, which would pass through Carlisle or its immediate vicinity. If the L. & N.E. Railway decided to electrify its line between Newcastle and Carlisle there would be sound reason for electrical interconnection with the North-East Coast companies. Carlisle would have to extend its area of operations in the rural districts around, and the gap between the North-East Coast and Carlisle developments would be lessened. It would be extremely foolish to say that Carlisle would remain isolated.

Speaking of the development of electricity in the country, Sir John said that a conservative estimate of the consumption in the country amounted to six thousand million electrical units, but his own idea was that it would rise to six times that amount. The Government had decided upon a scheme of twenty-one thousand millions by 1940. Sir John paid a high tribute to the technical skill and ability of the city electrical engineer, Mr. C. W. Salt, M.I.E.E.

In reply to a toast, Mr. Salt said that in designing the station he had felt it his duty not to permit the question of abnormal high efficiency to become an obsession. He had found that with moderate-sized power units the saving due to reduced coal consumption was overweighted by the increased capital outlay without consideration of the probability of increased maintenance charge. This view applied to local conditions only. He had worked along the lines of introducing elasticity in the lay-out which would permit, when the occasion arose, of introducing plant which would give an overall higher thermal efficiency. The whole problem of economical electricity supply was not confined to generation and transmission; a third and very important factor was the consumer and his consuming devices. The co-operation of the consumer was essential to economical supply, and the sympathetic consideration of the consumer was helpful during the present stage of development when high capital charges for a temporary period might almost equal the advantages of lower working costs.

Sign Floodlighting.

An interesting example of electric floodlighting is to be seen at the Rugby works of the British Thomson-Houston Co., Ltd., where the method is applied to three large signs placed over the works. One of these, measuring 80 ft. in length, is floodlighted at night by a battery of six B.T.-H. projectors, arranged in a single row on a roof 50 ft. below the sign. A B.T.-H. monogram sign, measuring 18 ft. across the circle, is illuminated by a similar arrangement. A battery of six projectors in a single row is situated at a distance of 83 ft. from the sign. The third sign, 76 ft. long, is served by a similar battery 86 ft. away. All the projectors are provided with plain mirror reflectors and equipped with Mazda gasfilled projector lamps.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. P. N. RAND, who recently relinquished his appointment as general sales manager of the Metropolitan-Vickers Electrical Co., has been appointed to a similar post with the English Electric Co., and will take up his duties as soon as his present commitments permit. We understand that Mr. Rand was originally on the staff of Siemens Bros. Dynamo Works, which is now part of the English Electric organisation. He left them to join the British Westinghouse Electric & Manufacturing Co.

On May 16th, in the Upper Dining Room at the Metropolitan-Vickers works at Trafford Park, Captain Hilton presented to Mr. P. N. RAND a magnificent gold cigarette case and a white skunk motor rug, subscribed for by his many friends in the company. Captain Hilton referred to the valuable services Mr. Rand had rendered to the company and the regret that all who came in contact with him felt when it

Mr. P. N. Rand.

became known that he had decided to sever his long connection with it. Mr. Rand, in reply, remarked that he had recently had a tooth out, but of the two ordeals, would much prefer to have got this ceremony over and still have to face the dentist. Mr. Rand carries with him the heartiest good wishes for success in whatever direction his future activities may lie.

Miss EDNA GARDINER, who, as announced elsewhere in this issue, won the first prize in the E.D.A. ballot, is a typist in Bristol. The Electrical Development Association has sent us a portrait of Miss Gardiner, which is reproduced herewith.

Miss Edna Gardiner.
Winner of the E.D.A. Ballot Competition.

She has expressed a preference for the £2,000 cheque instead of the all-electric house, and says that she intends to invest the money and continue in business. Mrs. Gardiner, who won the fifth prize, is Miss Gardiner's mother; her father was not successful—but neither were many others of us.

On Saturday last a presentation was made to Mr. G. R. SPURR, who completed 21 years' service as electrical and tramway engineer to the Walthamstow Council last month. Councillor H. Frost, chairman of the Council, made the presentation on behalf of the staff and employés of the two departments. It took the form of a coffee service, a suit case, and pipe. Councillor Frost spoke in warmest praise of Mr. Spurr's service, and attributed the present satisfactory position of the undertaking largely to his technical and managerial skill. Mr. V. L. McEntee, chairman of the Electricity and Light Railway Committees, followed. Mrs. Spurr was presented with flowers by the only lady member of the staff. In his reply, Mr. Spurr recalled some lively incidents of the days of gas producer plant, and among other things mentioned that he had recently celebrated his silver wedding.

Mr. J. H. C. BROOKING, M.I.E.E., will shortly be leaving the St. Helens Cable & Rubber Co., Ltd., to join the Greenwich Cable Works, Ltd., of Crooms Hill Works, Greenwich, as managing director. For the present his home address is "The Milestone," Bath Road, Slough.

The Poplar Borough Council has expressed high appreciation of the services of the borough electrical engineer, the staff of his department, and other officers concerned in the excellent arrangements made on the occasion of the opening of the new generating station.

The Department of Overseas Trade announces that Mr. J. W. BRIGDEN has been appointed Trade Commissioner at Cape Town in succession to Major G. Fetherston, D.S.O., M.C. Mr. Brigden will sail for South Africa on June 10th. Mr. Brigden will be Junior Trade Commissioner and will have offices at Johannesburg (P.O. Box 839, Goldfields Buildings, Eloff Street). Mr. N. Elmslie is Senior Trade Commissioner, and has recently moved his headquarters from Johannesburg to Cape Town.

At the annual meeting of the National Joint Board of Employers and Members of Staff (Electricity Supply Industry) held on May 20th, Alderman W. WALKER, M.I.E.E. (Manchester) was appointed chairman for the eighth successive year, and Mr. A. W. CROMPTON, A.M.I.E.E., president of the Electrical Power Engineers' Association, was appointed vice-chairman.

As stated in our "Business Notices," Dr. H. R. WRIGHT, managing director Siemens Bros. & Co., Ltd., has joined the board of the British Columbia Telephone & Telegraph Co.

The Chesterfield Town Council is recommended to increase the salary of the borough electrical engineer from £700 to £800, with a maximum of £900; that of the tramway manager from £650 to £750, maximum £800; that of the station superintendent from £456 to a maximum £500; and that of the deputy tramway manager from £355 to £400, maximum £450.

Mr. W. J. H. WOOD, borough electrical engineer of Bolton, has been appointed engineer-in-chief to the County of London Electric Supply Co., Ltd., in succession to Mr. Archibald Page. In accepting Mr. Wood's resignation on May 27th, the Bolton Electricity Committee recorded its "great appreciation of the excellent and valuable services rendered by him in the department, which have resulted in the undertaking being successfully developed."

The marriage took place at the Parish Church, Ospringe, on May 25th, of Mr. E. F. BESWICK, manager for Messrs. Jabez Smith & Son, electricians, of Faversham, and Miss H. J. MITCHELL.

Obituary.—MR. J. J. S. MACLAREN.—The death occurred on May 24th, of Mr. James Joseph Stainton Maclaren, chairman of Carron Company, in his 85th year.

MR. J. H. WOODWARD.—We learn with great regret of the death of Mr. John Harold Woodward, a partner in the firm of Messrs. Preece, Cardew & Rider, consulting engineers, at the age of 62. Mr. Woodward was born in Macclesfield; his father was connected with the silk manufacturing industry. After spending a short time in his father's silk mill, he went, in 1882, to Owens College, Manchester, and took up engineering studies. He became specially interested in electrical work and in 1885 he joined the technical staff of Elwell-Parker, Ltd., at Wolverhampton, where Thomas Parker was developing various early dynamos, alternators, and secondary batteries. The company was absorbed by the Electric Construction Company in 1889, and the lay-out of the new works at Bushbury, Wolverhampton, was due to a great extent to Mr. Woodward. He designed much of the work for the electrification of the Liverpool Overhead Railway in 1890, and for other early electric railways and tramways. The first alternators used by the Metropolitan Electric Supply Company in Manchester Square and Rathbone Place, erected in 1889, were of his design. Subsequently, when Thomas Parker left the Electric Construction Company, Mr. Woodward went with him, and the works of Thomas Parker, Ltd., were developed also at Wolverhampton. In 1899, he joined Messrs. Preece & Cardew, and in 1909 he was made a partner in the firm which became Preece, Cardew, Snell & Rider, and later, on Sir John Snell's retirement, Preece, Cardew & Rider. Mr. Woodward was largely associated with the firm's lighting, tramway and railway work in this country, the Colonies, and foreign countries. He visited the United States, Australia, New Zealand, and South America. Among the electricity supply and tramway undertakings upon which he was recently engaged, were Wellington, Auckland, Dunedin, Sydney, Brisbane, Shanghai, Hong Kong, Buenos Aires, &c. Mr. Woodward was married in 1905 and he leaves a widow and one daughter.

MRS. HOADLEY.—We wish to express our sympathy with Mr. E. E. Hoadley, borough electrical engineer at Maidstone, whose wife passed away on May 26th in her 48th year. Mr. and Mrs. Hoadley celebrated their silver wedding in April last.

MR. C. LEHMANN.—Mr. Charles Lehmann, late of the Eastern Telegraph Co., Ltd., died at Vigo, Spain, aged 67 years, on May 18th.

MR. L. LILLEY.—The death is announced of Mr. Leonard Lilley, who was for the past 14 years on the staff of the General Electric Co., Ltd., at Witton. He was 41 years of age.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Regent Electrical Co., Ltd.—Private company. Registered May 25th. Capital, £400 in £1 shares. Objects:—To acquire the business of a dealer in electric lamps carried on by A. F. Lowe as "The Regent Electric Lamp Co." at 7, Finsbury Pavement, E.C. The permanent directors are:—A. F. Lowe, 128, Chestnut Avenue, E.17, estate agent; T. W. McEwen, 16, Briar Avenue, S.W.16, merchant. Solicitors: Bein & Lawrence, 72, Finsbury Pavement, E.C. Registered office: 72, Finsbury Pavement, E.C.2.

Auto-Electric Advertising Co., Ltd. — Private company. Registered May 23rd, with a nominal capital of £2,000 in 1s. shares. The objects are to carry on the business of advertising contractors and agents, manufacturers of and dealers in apparatus, appliances, plant and material employed by such contractors, electrical and general engineers, &c. The first directors are:—Sir Frank C. Meyer, Bt., M.P., 18, Lowndes Street, S.W.1. (director of British Industrial Corporation, Ltd.); Sir Alan Burgoyne, Fincher's House, Amersham, director of companies; H. Fitzpatrick, 24, Throgmorton Street, E.C.2; C. W. C. Lynfield, 82, North Gate, N.W., gentleman; I. Rapaport, 26, Belsize Lane, N.W.3; A. F. H. S. Simpson, C.M.G., Windham Club, St. James's Square, S.W.1. Qualification, 100 shares. Remuneration, £250 each per annum (chairman £350). Solicitors: Wild, Collins & Crosse, Kennans House, Crown Court, Cheapside, E.C.2.

Abbey Cables, Ltd.—Private company. Registered May 23rd. Capital, £2,000 in £1 shares (1,000 preferred ordinary and 1,000 ordinary). Objects: To carry on the business of manufacturers of and dealers in telegraphic, telephonic, and all other kinds of electric and other cables, &c. The subscribers (each with one share) are:—S. G. W. Norton, "Reo," Woodcote Valley Road, Purley, electrical engineer; A. Maguire, 36, Eaton Place, Belgravia, S.W., gentleman. Solicitors: Gordon, Gardiner, Carpenter & Co., 7, Serjeants' Inn, Temple, E.C.4.

R. A. Poole (London), Ltd.—Private company. Registered May 23rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of a wholesale electrical supplier and distributor of electric lamps, wireless valves, wireless apparatus and accessories, motors and accessories, and electric cables, carried on by R. A. Poole, at 67, Goldhawk Road, Shepherd's Bush, W., as "Poole's Electric Lamp and Accessories Co." The directors are:—R. A. Poole, 67, Goldhawk Road, Shepherd's Bush, W.12; Mrs. M. K. Poole, 7, The Common, Ealing, W.5. Qualification, £10 shares. Solicitor: A. C. Jaques, 102, Colmore Row, Birmingham. Registered office: 67, Goldhawk Road, Shepherd's Bush, W.

Weenen, Goddard & Co., Ltd.—Private company. Registered May 26th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical engineers and contractors, &c. The permanent directors are:—H. H. Weenen, 22, St. James' Mansions, West Hampstead, N.W.6, electrical engineer; A. G. Goddard, "Westholme," 67, Rancliffe Road, East Ham, E.6, electrical engineer. Solicitors: Bartlett and Gluckstein, 199, Piccadilly, W.1.

Victor X-Ray Corporation, Ltd.—Private company. Registered May 21st. Capital, £1,000 in £1 shares. Objects: To manufacture and deal in Röntgen or X-ray electro-therapeutic, electro-surgical, scientific, chemical, medical or mechanical machinery, tools, instruments, appliances, and devices, &c. The company has the right of the trade mark "Victor." No. 370,638. The directors are:—L. M. Forsyth, Morley House, Regent Street, W.1, electrical engineer; J. F. Stewart, Crown House, Aldwych, W.C.2, secretary; V. J. Radbone, 268, St. James' Court, S.W.1, electrical engineer. Solicitor: A. R. Monks, Crown House, Aldwych, W.C.

W. D. Willson, Ltd.—Private company. Registered May 19th. Capital, £1,500 in £1 shares. To adopt an agreement with W. D. Willson, and to carry on the business of electric, telephonic, and wireless engineers, dealers in electrical and wireless fittings, &c. The first directors are:—W. D. Willson, 1, Fell Road, Croydon, electrical engineer (life director); A. A. Baster, 22, George Street, Croydon, incorporated accountant; Mrs. F. C. Willson, G. W. Adams, and J. McCarthy (addresses not stated). Qualification of life director, 200 ordinary shares; of other directors, £10. Registered office: 1, Fell Road, Croydon.

Triotron Radio Co., Ltd.—Private company. Registered May 27th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of thermionic valves. The subscribers (each with one share), are:—A. Kinge, 25, Glenburnie Road, Upper Tooting, S.W.17, clerk; A. W. Harwood, Police Station, Staines, Middlesex, clerk. J. Axelrad is first and permanent director. Qualification, 5 shares. Solicitors: Philip Conway Thomas & Co., 80, Rochester Row, S.W.1. Registered office: 80, Rochester Row, Westminster, S.W.1.

Official Returns of Electrical Companies.

Carmichael & Partners, Ltd.—Capital, £500 in £1 shares. Return dated August 31st, 1926 (filed March 21st, 1927). 52 shares taken up. £52 paid. Mortgages and charges, nil.

Hambling, Clapp & Co., Ltd.—Return dated November 18th, 1926. Capital at date of return: £1,000 in £1 shares (increased November 24th, 1926, to £2,500 in £1 shares). 472 shares taken up. £472 paid. Mortgages and charges, nil.

Tungstone Accumulator Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 29th, 1926 (filed March 21st, 1927). 500 shares taken up. £500 paid. Mortgages and charges, nil.

Spa Radio Co., Ltd.—Capital, £1000 in £1 shares. Return dated May 28th, 1926 (filed April 8th, 1927). 460 shares taken up. £460 paid. Mortgages and charges, nil.

Lancashire Telephone Systems, Ltd.—Return dated January 12th, 1927. Capital at date of return: £3,000 in £1 shares (increased March 15th, 1927, to £4,000 in £1 shares). 1,705 shares taken up. £1,705 paid. Mortgages and charges, £250.

Weald Electricity Supply Co., Ltd.—Capital, £40,000 in £1 shares. Return dated December 6th, 1926. 5,504 shares taken up. £1,504 paid. £4,000 considered as paid. Mortgages and charges at date of return, nil. Issued January 1st, 1927, £50,000 debentures (part of series of £100,000 authorised December 15th, 1926).

Carlisle and District Transport Co., Ltd. (formerly The City of Carlisle Electric Tramways Co., Ltd.).—Capital, £60,000 in £1 shares. Return dated March 1st, 1927. All shares taken up. £60,000 paid. Mortgages and charges, £40,000.

Chislehurst Electric Supply Co., Ltd.—Capital, £15,000 in £5 shares. Return dated April 25th, 1927. All shares taken up. £15,000 paid. Mortgages and charges, nil.

Automatic Coil Winder and Electrical Equipment Co., Ltd.—Capital, £10,000 in 8,000 ordinary and 2,000 deferred shares of £1 each. Return dated February 21st, 1927. All shares taken up. £3,000 paid. £7,000 considered as paid. Mortages and charges, £2,800.

Ventimotors, Ltd.—Capital, £8,000 in £1 shares. Return dated February 11th, 1927. All shares taken up. £8,000 paid. Mortgages and charges, nil.

Electron Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 14th, 1927. 970 shares taken up. £970 paid. Mortgages and charges, £3,500.

Lacy Patents Holding Co., Ltd.—Capital, £1,000 in 1s. shares. Return dated December 31st, 1926. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

F. C. Brown (Electricity), Ltd.—Capital, £1,000 in £1 shares. Return dated December 15th, 1926 (filed March 25th, 1927). All shares taken up. £25 paid. £975 considered as paid. Mortgages and charges, nil.

Gauntletts, Ltd.—Capital, £40,000 in 35,000 cum. preference shares of £1 each and 200,000 ordinary shares of 6d. each. Return dated December 31st, 1926. All shares taken up. £25,000 paid on 25,000 preference shares. £15,000 considered as paid on 10,000 preference and 200,000 ordinary shares. Mortgages and charges, nil.

Neon Lights (1923), Ltd.—Capital, £30,000 in £1 shares. Return dated December 31st, 1926. 27,000 shares taken up. £12,000 paid. £15,000 considered as paid. Mortgages and charges, £1,500.

Automobile Electrical Repairers, Ltd.—N. J. Dodd, of Sardinia House, Sardinia Street, W.C.2, ceased to act as receiver or manager on May 16th, 1927.

Electrical Devices, Ltd.—S. A. S. Forster, C.A., of County Chambers, Middlesbrough, was appointed receiver on May 18th under powers contained in debenture dated January 5th, 1927.

Claremont, Johnson & Co., Ltd.—W. J. Hodge, of 26-27, Union Bank Buildings, Holborn Circus, E.C.1, ceased to act as receiver or manager on May 2nd, 1927.

Bedale and District Electric Supply Co., Ltd.—Particulars filed of £2,000 debentures authorised February 7th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Satisfaction in fall on May 14th, 1927, of debenture dated January 16th, 1920; debenture dated November 7th, 1921; and mortgage dated November 7th, 1921, securing £1,500, £600, and £2,100 respectively.

Clear Hooters, Ltd.—Particulars filed of £8,000 debentures authorised May 5th, 1927, charged on the company's undertaking and property (subject to first and second mortgage debentures issued or to be issued for sums not exceeding in the aggregate £2,200 and £1,000 respectively) the amount of the present issue being £5,250 7s. 4d.

Century Cables, Ltd.—Mortgage debenture dated May 11th, 1927, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders:—Sir Edward Nicholl, K.B., J.P., D.L., Littleton Park, near Shepperton; and R. G. Ellis, Netherside Hall, Skipton-in-Craven, Yorks.

Rose Bros. Electrical Co., Ltd.—S. G. Morris, of 6, Wardrobe Place, Doctors' Commons, E.C.4, was appointed receiver and manager on May 13th, 1927, under power contained in debenture dated August 23rd, 1921.

Uneeda Supplies Co., Ltd.—Particulars filed of £1,000 debentures authorised April 25th, 1927, charged on the company's property, present and future, the amount of the present issue being £400.

City Notes.

Eastern Telegraph Co., Ltd.

The annual meeting was held on May 24th. Sir John Denison-Pender, G.B.E. (chairman), who presided, referred to the death of Mr. A. R. Hardie, a director, who had been associated with the company for 55 years. Dealing with the report (ELECTRICAL REVIEW, May 20th, p. 810), the chairman said the results could be considered satisfactory in view of the depressing conditions which existed during the greater part of the year. They had received a contribution from one of their subsidiary companies of £206,500, and had thus been able to write off entirely the remaining balance of £493,000 in respect of expenditure on new cables and cable renewals. Nearly four and a half million pounds had been charged against the reserve fund since the Armistice in respect of new cables and cable renewals, and since the company was formed approximately twelve million pounds had been so charged. Their negotiations with the British and French administrations with regard to the direct line between Paris and London had been successfully concluded, and the new direct route was opened for service on March 1st last. Negotiations had practically been completed both with the Palestine and Egyptian administrations for the laying of a new cable between Egypt and Palestine. The negotiations with the Greek Government had been brought to a satisfactory conclusion, and they had been granted a concession for 50 years. Negotiations were recently re-opened with Turkey, and a convention had been agreed

upon and signed, and now only awaited ratification. It had been decided to lay further submarine cables between Alexandria and Port Said and underground lines between Port Said and Suez. The improved means of communication would enable them to install their direct regenerator system between London and India, with substantial benefits to the service. Thirty-one cables of the associated companies were now being operated by the regenerator system; this gave considerable increase in capacity with resultant gain in transmission times. Having carefully watched the development of wireless during the past 30 years, he (the chairman) had no cause to alter the opinion formed and expressed over that period that the cables would remain more reliable than the wireless service. The prospect of the return to normal trade conditions would counterbalance to a very large extent the present day competition with which they were faced, but the obvious solution, in the interests of the public and others, was co-operation in some form or another which would eliminate wasteful and unremunerative expenditure and, at the same time, provide a dual and alternative means of communication. Given a fair field for the unrestricted development of the cable industry, it would continue to prove itself the best and most reliable means of telegraphic communication.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The annual meeting was held on May 26th, under the presidency of Sir John Denison-Pender (chairman). In presenting the report (ELECTRICAL REVIEW, May 20th, p. 811), the chairman said that the increase of £93,106 in the gross revenue was due to two "windfalls," not to be expected to recur. One of these represented refunds of income tax received from the Netherlands Indian Government, and the other was an amount which had been held in suspense pending the result of a lawsuit which was decided in favour of the company. The actual traffic receipts showed a decrease of £35,115, but in view of the disorganised trade conditions, the result could not be considered as unsatisfactory. In conformity with the action taken by the cable system worked by the Pacific Cable Board their tariff had been reduced. That reduction of tariff and the competitive "beam" service must naturally result in a certain loss of revenue. Their thanks were due to the Commonwealth Postal Department for the speedy construction of the new land-line between Adelaide and Perth, which was handed over to the company on March 25th last. Worked in conjunction with the duplicate Perth-Cocos cable, it had already proved itself a valuable adjunct to the system.

With the state of affairs at present ruling in China, it had been found impossible for the Great Northern Telegraph Company and themselves to continue negotiations with the Chinese Telegraph Administration, and these had been postponed until a more opportune time. China failed to pay the instalment of a loan which fell due on June 30th, 1922, and after extending every possible consideration and realising that affairs in China were not tending to become stabilised, but rather the reverse, the companies decided to exercise their lien, whereby amounts falling due to the Chinese Administration as its share of the revenue derived under the joint purse agreement had, since January, 1927, been retained by the companies and placed towards the liquidation of outstanding instalments. Interruptions of their cables had been few in number, and, owing to duplication throughout the system, quite immaterial.

Oriental Telephone and Electric Co., Ltd.

The report for the year ended December 31st last records a net revenue of £68,282, and after adding £14,219 brought forward and deducting interim dividends, there remains a balance of £58,735. After paying the final preference dividend it is proposed to distribute a final dividend of 6 per cent. on the ordinary shares (making 10 per cent., free of tax, for the year), together with a tax-free bonus of 2 per cent., leaving £17,812 to be carried forward. Satisfactory progress was made by the Singapore branch and the Hongkong Telephone Co., Ltd. The Mauritius branch again showed an adverse result, the increased rates not having been authorised yet. The heavy charges which had to be met by the Bombay Telephone Co., Ltd., precluded the payment of a dividend. The Bengal Telephone Corporation, Ltd., paid a dividend of 6 per cent. (free of Indian income tax), as against 2 per cent. The Madras Telephone Co., Ltd., repeated its dividend of 7 per cent., free of Indian tax, but the Rangoon Telephone Co., Ltd., was forced to reduce its dividend from 8 to 5 per cent., free of Indian tax, owing to special charges for depreciation. The Hongkong Company paid dividends amounting to 8 per cent., enabling the China and Japan Telephone Co. to pay 15 per cent., free of tax. The staff pension fund has now been instituted. Sir Thomas S. Catto, Bt., has been appointed to a vacancy on the board caused by the resignation of Mr. G. P. Ness. Meeting: To-day (Friday).

Lancashire Electric Light and Power Co., Ltd.

The annual meeting was held on May 23rd, Mr. A. Shepherd, W.S. (chairman) presiding. In presenting the report and accounts (ELEC. REV., May 20th, p. 810), the chairman said that a considerable amount of cables had been laid during the year; the capital expenditure amounted to over £467,000. The sales of energy had risen from 130,558,000 kWh to 146,580,000. The new Padiham station, which was put into operation in January this year, had proved very efficient; it would eventually be raised to 50,000 kW. Additional plant was necessary for the development of the southern part of the company's area, and the company had therefore purchased a site at Kearsley and had asked the Electricity Commissioners for permission to build a station there. The Commissioners had agreed to this, subject to a condition with which the company was willing to conform. The plans provided for a station housing four 31,250-kW sets, but arrangements had been made to provide for two further sets. It was hoped to have the first two sets ready for the winter of 1929-30. The initial capital cost was estimated at £875,000, and the cost with four sets installed at £1,645,000. Dealing with the progress of the company, the chairman said that since 1906 the revenue had risen from £5,300 to £582,300, the maximum demand from 2,060 kW to 60,340 kW, and the energy sold from 3,043,000 kWh to 146,580,000 kWh. After mentioning the issue of preference shares which was made in November last, the chairman said that for the purpose of providing funds for the construction of the Kearsley station it was intended to make an issue of debenture stock at a favourable opportunity.

Oliver Pell Control, Ltd.

Owing to the industrial conditions last year the turnover of this company declined from £92,292 to £67,856. The net profit was £1,520, and the addition of £7,281 brought forward makes available £8,801. After deducting the interim dividend on the 8 per cent. preference shares and writing off the preliminary expenses of a preference share issue, a balance of £5,846 is carried forward. At the annual meeting on May 18th, Mr. Charles Oliver (chairman) said that the directors were pleased that the results were so good as they were, in view of the conditions. The directors, who held the bulk of the ordinary shares, considered it advisable not to pay an ordinary dividend. In September last they entered the wireless trade and had already established a reputation; that branch had enabled them to show a profit. The turnover of the switch department showed an increase of 42 per cent., but that of the coil-winding department fell by 50 per cent. and mainly accounted for the fall in the revenue. They proposed to institute a bonus system for their workpeople when the state of trade warranted it. The new R.I. & Varley, Ltd., was to market the radio products of themselves and Radio Instruments, Ltd.

Chili Telephone Co., Ltd.

The *Financial Times* reports that a circular has been issued to shareholders stating that half of the company's shares have been acquired by a purchaser at £8 per share, and that the same purchaser is prepared to buy all or any of the remaining shares at the same price. The directors make no recommendations. The company has an authorised capital of £1,000,000 in £5 shares. Our contemporary says that it is in a position to state that the buyer is Colonel Behn, acting on behalf of the International Telephone and Telegraph Corporation.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

The report for 1926 shows a balance to the credit of the profit and loss account of £140,582, and after providing for debenture interest there was a net loss of £531,210, which reduces the balance brought forward to £114,181. The report states that a revaluation of properties will have to be made, and in due course proposals for a reconstruction and the reduction of the company's capital will have to be made. Certain alterations in the articles are to be put forward at an extraordinary meeting to be held after the annual meeting on June 9th.

Mexican Light and Power Co., Ltd.

A meeting of the holders of the company's 5 per cent. second mortgage 50-year bonds was held last week, when Mr. E. R. Peacock, chairman of the Bondholders' Committee, explained a scheme for dealing with arrears of interest. He said that it was proposed to fund the arrears up to December 1st last by the allocation in respect of each £100 bond, £7 10s. in cash, and £50 par value of bonds of the same issue. The proposals were approved.

Electric Construction Co., Ltd.

The directors recommend a final ordinary dividend at the rate of 9 per cent. per annum, making 7½ per cent. for the year. This rate has been paid for several years, but since 1917-1918 a bonus of 2½ per cent. had also been distributed, but this is not repeated.

Penarth Electric Lighting Co., Ltd.

The net revenue for the past year was £11,075 (against £11,493). After adding £2,924 brought forward and providing for renewals, &c., it is proposed to place £2,000 to reserve and to pay an ordinary dividend of 7½ per cent., leaving £2,482 to be carried forward.

Reduction of Capital.

Premier Electric Welding Co., Ltd.—An extraordinary meeting is to be held on June 17th to consider resolutions for the reduction of the capital from £100,000 to £26,250. This is proposed to be effected by the cancellation of 12,900 unissued shares and of 14s. per share of the 87,500 issued £1 shares.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted :—

Constantinople Telephone Co.—£200,000 6 per cent. Obligation Bonds of £100 each, Nos. X10,001 to X12,000; and £95,436 6 per cent. certificates, Nos. 1 to 3,993 and 4,002 to 4,346 of £22 each (Bearer).

White (J. G.) & Co., Ltd.—360,000 ordinary shares of 4s. each fully paid Nos. 1 to 360,000.

The undermentioned securities have been ordered to be officially quoted :—

City of London Electric Lighting.—400,000 ordinary shares of £1 each, fully paid, Nos. 1,500,001 to 1,900,000.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Baird Television Development.—400,000 deferred ordinary shares of 1s. each, fully paid, Nos. 100,001 to 500,000.

Electrical Finance and Securities.—Option certificates (to bearer) in respect of 20,000 ordinary shares at par, until January 1st, 1931.

Low Temperature Carbonisation.—1,516,569 shares of 2s. each, fully paid, Nos. 2,878,389 to 4,067,411 and 5,120,586 to 5,448,131.

White (J. G.) and Co.—360,000 ordinary shares of 4s. each, fully paid, Nos. 1 to 360,000.

Colombo Electric Tramways and Lighting Co., Ltd.

The report for the past year shows a net revenue of £123,413, and a balance, after providing for debenture interest, and adding the amount brought forward, of £175,696. From this £9,900 is transferred to general reserve and renewal fund, which has to be dealt with by writing off £9,900 to special renewal account. £60,000 is transferred to debenture stock redemption and account, and a dividend of 20 per cent., free of tax (as against 15 per cent.), is recommended, leaving £79,628 to be carried forward.

Pinchin, Johnson & Co., Ltd.

The usual dividend at the rate of 6¼ per cent. per annum has been declared on the preference shares in respect of the half-year ending June 30th.

Glenfield & Kennedy, Ltd.

The profit for the past year fell from £77,657 to £59,762. The final ordinary dividend is 6 per cent., making 10 per cent. for the year, as for 1925-26.

British Columbia Electric Railway Co., Ltd.

The directors have declared a dividend of 4½ per cent., free of tax, on both the preferred and deferred ordinary stocks, as in 1926.

General Electric Co.

This American company has declared a quarterly dividend of $1, as against 75 cents, together with an extra dividend of $1.

British Thomson-Houston Co., Ltd.

The dividend on the 7 per cent. cumulative preference shares in respect of the half-year ended June 30th has been declared.

Western Telegraph Co., Ltd.

A third quarterly dividend of 5s. per share, free of tax, has been declared.

American Telephone and Telegraph Co.

The regular quarterly dividend of $2.25 has been declared.

German Companies.

The *High Frequency Machine Company for Wireless Telegraphy*, Berlin, reports net profits of 89,000 marks for 1926, as compared with 86,000 marks in the previous year, the dividend again being 8 per cent. A further sum was received during the year on the former holdings of Marconi shares. On the other hand, the satisfaction of the American claims was still uncertain, as compensation for radio stations has been struck out of the Bill now under consideration.

The *Lloyd Dynamo Works Company*, Bremen, states that it was impossible fully to occupy the plant in 1926 owing to the lack of orders for large machines, the low prices for small motors and the depression in the shipbuilding industry. A total loss of 929,000 marks is recorded as against one of 158,000 marks in 1925. It is proposed to extinguish the loss by a reduction of capital.

The *C. Lorenz Company*, Berlin, states that the turnover in 1926 showed an increase over the previous year, although at falling prices. The net profits amounted to 418,000 marks, as against 552,000 marks; the dividend is reduced from 8 per cent. to 6 per cent.

French Companies.

The *Société d'Electro-Métallurgie, Electro-Chimie et Aciéries Electriques d'Ugine* reports a net surplus of 10,660,000 fr. for 1926, including the balance forward, comparing with 9,000,000 fr. in the preceding year. It is intended to increase the dividend from 45 fr. per share to 50 fr.

The *Société Thomson-Houston* reports net profits of 27,245,000 fr. for 1926, the amount available with the balance brought forward being 30,326,000 fr. It is proposed to apply 15,000,000 fr. to the reserve redemption fund for buildings, plant and equipment, and 3,000,000 fr. to meeting fluctuations in the prices of raw materials, the balance of over 12,000,000 fr. being carried forward.

The *Compagnie D'Appareils Electriques et Compteurs Garnier*, Lyons, records net profits of 432,000 fr. for 1926, as compared with 402,000 fr. in the previous year; the dividend is increased from 75 fr. to 80 fr. per share.

Belgian Company.

The *Société d'Electricité et de Mécanique* (*Procédés Thomson-Houston et Carels*), Brussels, reports a net balance of 378,000 fr. for 1926, which has been carried forward. The directors state that the concentration of work on certain types of machines has permitted of a reduction in the prime costs and an improvement in the quality, the transformer department in particular having developed. The industrial installation branch continued to progress, but competition remained very keen.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have recovered to a great extent from the disappointment experienced at the failure of the Bank rate to fall to 4 per cent. The depression in prices which was caused by the retention of the rate at 4½ per cent. became accentuated by the turn of Russian events. Moreover, the flood of new issues which hastened to get ahead of the Whitsun holidays left the markets with an *embarras de richesse*. So plentiful, however, is the supply of fresh money that the newcomers have found no difficulty in securing homes more permanent than those of stags and underwriters. It may give some idea of the volume of business which is being transacted to state that, on the last Stock Exchange account-day, the business in County of London Electric 5 per cent. debenture stock was alone sufficient to tax energies severely, and it was estimated that nearly half of the total issue of four million pounds must have changed hands on pay-day, May 26th. Investment demand is further illustrated by the rises that have occurred in the prices of cable stocks.

The group of South American telephone companies attracted a good deal of attention on a report, evidently well founded, to the effect that the International Telephone and Telegraph Co. of America can be regarded as the recent buyer whose support has caused such a rise in the prices of United River Plate Telephones and a few others. The International Telephone and Telegraph is also presumed to be the prospective purchaser who is offering to buy Chili Telephone shares from shareholders at £8 a share. The company states in a circular that half the shares have been acquired by a purchaser, and that he is prepared to buy all, or any, of the remaining issued shares at the same price. The offer had to be answered on the Wednesday in this week, and those who accept will receive cash against delivery of certificates on June 16th. The International Telephone and Telegraph Corporation is acting through Colonel Behn. It was only a couple of months ago that Montevideo Telephone shareholders received an offer of £2 a share from the same hand. International Telephone and Telegraph shares, of $100 each, have risen several points this week, to 144¼.

On the strength of these developments, Venezuela Telephones, ordinary and preference alike, have risen several shillings during the past few days to 28s., and Bogota Telephones strengthened to 37s. 6d. Bogota is, of course, in Columbia, and the company is one whose shares have been introduced fairly lately into the Stock Exchange market. Anglo-Portuguese Telephones have risen to 21s. 6d. Lord St. Davids has retired from the board and chairmanship of the company, Sir Alexander Roger having taken his place. Sir Alexander is chairman of the Automatic Telephone Manufacturing Company, and the International Automatic Telephone, and director of several other concerns. It is understood that he has bought out some of the largest proprietors and has secured control of the Anglo-Portuguese Telephone Company on behalf of other interests. It is claimed that this deal will leave the control of the company in British hands, an obvious advantage at a time when Americans are actively engaged in endeavours to obtain a hold upon telephone companies in various parts of the world.

At the meeting of Siemens Bros. & Co., the chairman pointed out that the telephone industry is particularly suited to relieve the present industrial difficulties. For every million pounds spent by the Government on telephony, he said, employment was provided for approximately six thousand workpeople, while the national expenditure on telephones augmented the national revenue. Siemens are, it is scarcely necessary to say, very intimately connected with various branches connected with telephony. The shares at 27s. 6d. ex dividend show no actual change beyond the amount deducted for the dividend. Brush ordinary are also ex at 26s. 3d. Mr. Garcke said at the meeting that all the main departments of the company's business were kept well occupied throughout the past year. A disappointment is afforded by the dividend announcement of the Electric Construction

Company: no bonus is to be added to the 7½ per cent. rate paid for many years. From 1919 to 1925, an annual bonus of 2½ per cent. accompanied the dividend. No nominal change occurred in the price, but actually the market has weakened, and shares have been changing hands around 27s. 3d. Doubtless the report will debit the coal stoppage with causing the disappearance—it is expected to be only temporary—of the bonus. Henleys have come down 1s. to 88s. 9d., the cable equipment list being disposed to droop. British Aluminiums have shed a trifle, at 43s.

United River Plates touched 9 11/16ths, before the rise tempted shares to market, and the price reverted to 9⅝. Oriental Telephones spurted sharply to 56s. 3d., this showing a gain of 2s. 9d. The company is again paying 10 per cent., tax free, for the year, and the 1926 profit, £68,300, is about £1,200 more than that secured in 1925. Automatic Telephones are unaltered at 45s., but Internationals tread closely upon the heels of £2, which is higher on the week. There has been fairly persistent buying of Marconis up to 20s., and Canadian Marconis rose a little to 4s. 3d. bid.

Once more, a spectacular rise in Brazilian Tractions stands out as the chief feature in our price-lists. An advance of 7½ points has lifted the shares to 154, and the preferred sympathetically strengthened to 129. Explanation of the long-continued strength is crystallising into categorical rumour that each share is to be split into three, and that upon the latter the dividend will be 2½ per cent. This rate would be equal, of course, to 7½ per cent. upon the existing shares, now in receipt of 6 per cent. There seems to be sound reason for the assumption that, as regards the splitting scheme, rumour is likely to be correct. The company's earnings, also, are good enough to warrant hopes of increased distributions in the near future. Barcelona Trams have been less animated than of late, and now stand at 50. Sidros, in which interest has also subsided to some extent, are 15½. Mexican Light and Power preferred strengthened to a slight extent. The company is said to have announced its intention of spending 14 million dollars upon developments. Buenos Aires Lacroze 6½ per cent. debenture stock can be bought, free of stamp and fee, at its issue price of 96½, or a trifle less.

Of other new stocks, Electrical Finance and Securities 5½ per cent. debenture stock, which came out at 92½, is quoted at 1½ premium, and the 7 per cent. preference shares at a premium of 6d. each. Both can be bought in scrip form, thus saving the purchaser the cost of Government stamp. The same advantage applies to the new County of London Electric 5 per cent. debenture, the price of which is 97½—a premium of 1½ points.

British Columbia Electric preferred is 2½ higher at 121. Deduction of the interest from the price of Anglo-Argentine Tramways 5 per cent. debenture has left the stock at 70½, bringing the yield to £7 1s. 10d. per cent. on the money. The Shanghai Electric Construction Company did well last year, the dividend being maintained at 10 per cent., and the profits of £122,400, the highest since 1920, being £50,000 more than those of the previous year. The shares have risen 2s. 6d. to 37s. 6d. Colombo Electric Tramways and Lighting ordinary shares are to receive 20 per cent., tax free, against 15 per cent. in each of the two preceding years. The company's earnings have expanded in remarkable fashion.

Bournemouth and Poole ordinary show a tendency to rally, and have braced up to 56s. 9d. Lancashire Light and Power ordinary at 26s. are ex dividend. The chairman quoted eloquent figures, at the meeting last week, to indicate the strides taken by the company's gross revenue, and the sale of current, over the past 21 years. He mentioned that the new station near Burnley, which came into commercial operation last January, has already shown itself to be highly efficient. A net decline of 9d. has left Urban ordinary at 25s. ex dividend. In the list of London electricity supply shares no alterations have to be noted. The Penarth Electric Lighting Company has declared a dividend of 7½ per cent. on its ordinary shares.

The report of the Electricity Commissioners on the generation of electricity in this country for the year ended March 31st, 1926, is regarded in the market as being too belated for it to possess more than an academic interest.

Home Railway stocks are unbefriended. A dull depression has settled over the market. Electric issues have gone the same way as steam stocks. Districts and Metropolitans have declined. London Electric ordinary keeps about 59. Underground Electric Railways are steady. The various London tramways descriptions remain without alteration. Of the foreign tramways shares, La Plata ordinary dwindled to 4s. 6d., after being up to 5s.

The iron and steel market is somewhat subdued by the Armstrong, Whitworth report for 1926, disclosing a loss of £531,000. That the results would be bad had been assumed in advance, but the official figures did nothing to temper previous apprehensions. On the other hand, there are tangible proofs, in the shipping industry, of returning trade, and these serve to encourage hopefulness in respect of the present year. The rubber share market looks for a better price of raw rubber to develop during the new month of June, as the effects of the latest restriction come into practical play. Business in the Stock Exchange is nothing to write home about, as the schoolboys say, and the main interest in the city has centred less upon stock and share prices than upon those quoted from a little place called Epsom.

Share List of Electrical Companies.

	Nom. £	Dividend. 1925.	1926.	Price May 30 1927.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14	14	56/9	+1/3	4 18 7
Brompton Ordinary	1	10	8½	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8½	25/-	—	5 12 0
City of London	1	15	10	1⅞	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	26/-xd	—	5 15 5
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅝	—	5 6 8
Metropolitan	1	11	8	29/-	—	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	23/-	—	4 6 11
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	7	7	25/-xd	—9d.	5 12 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	29/6	—	5 8 4
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	3	61	—1½	4 18 4
do. District	,,	3½	3½	61½	—1	5 13 10
Underground Electric	£1	Nil	1½	18/6	—	1 12 5
do. do. Income	Bonds	6	6	102	—	*5 17 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24½	+⅛	6 3 9
Automatic Telephone	1	3	10	45/-	—	4 9 0
Chili Telephone	5	5	6	7⅞	—	3 17 5
Eastern Extension	10	10	10	18⅝	+⅛	*5 6 8
Eastern Tel. Ord.	Stock	10	10	181½	—	*5 10 2
Globe Tel. and T. Ord.	10	10	10	18⅞	—	*5 6 0
do. do. Pref.	10	6	6	11	—	5 8 1
Great Northern Tel.	10	20	20	29½	+1	6 16 6
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	18/9	—	... ...
Marconi-Marine	1	7½	8⅝	27/-	—	6 9 8
Oriental Telephone Ord.	1	12	12	56/3	+2/9	*4 5 8
United R. Plate Tel.	5	8	8	9⅝	—	*4 5 4
Western Telegraph	10	10	10	17½	+½	*5 12 8
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8½	—	7 17 2
do. do. 2nd Pref.	5	6	6	8½	—	8 2 8
do. do. 5% Deb.	Stock	5	5	70½xd	—	7 1 10
British Electric Traction Ord.	,,	8	—	148	—	5 8 1
do. do. 6% Pref.	,,	6	6	120½	—	6 12 10
Brazil Traction	100	5	6	154	+7½	3 18 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	80½	—	5 11 9
do. do. Preferred		6¾	6¾	121	+2½	5 8 4
do. do. Deferred	,,	8	—	158	—	*5 1 3
do. do. Deb.	,,	4¾	4¾	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	52½	—	7 12 5
Mexico Trams, 5% Bonds	—	5	5	81½	—	6 2 8
Mexican Light Common	100	Nil	Nil	44	—	Nil
do. Pref.	100	Nil	Nil	110½	+½	Nil
do. 1st Bonds	—	5	5	74½	—	6 14 3
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	13	13	53/9	—	4 16 11
British Aluminium Ord.	1	12½	10	43/-	—9d.	4 13 0
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	67/6	—	4 8 11
Brush Ord.	1	10	10	26/3xd	—	7 12 4
Callenders	1	15	—	3⅞	—	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/6	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	7½	28/9	—	5 4 4
Enfield Cable Pref.	1	7½	7½	25/6	+6d.	5 17 8
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	88/9	—1/-	4 10 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 9
India-Rubber	1	5	5	1⅛	—	*4 9 0
Johnson & Phillips	1	17½	12½	2½	—	5 0 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	27/6xd.	—	5 9 1
Telegraph Construction	12	10	10	28½	—	*4 4 9

* Dividends paid free of Income Tax.

The Incorporated Municipal Electrical Association.—II.

Annual Convention at Buxton.

ON Monday last the Palace Hotel, Buxton, became the official headquarters of the I.M.E.A., *pro tem.*, and the President, with members of the Council, there welcomed informally members and visitors attending the Convention. Next morning, at the Opera House in the Pavilion Gardens, His Worship the Mayor of Buxton (Councillor W. Goodwin, J.P.) extended to the members a cordial welcome, expressing the pleasure of his Corporation at receiving so important an Association, and referring briefly to the exhilarating air and medicinal waters which were at the disposal of the visitors. Moving a vote of thanks, the President, Mr. R. W. L. Phillips, M.I.E.E., on behalf of the Association, thanked the Mayor and Corporation for their efforts to ensure the comfortable accommodation of those attending the Convention (the total number, we understand, was no less than 890); Alderman W. E. Souter, chairman of the Bedford Electricity Committee, warmly seconded the motion, which was carried by acclamation. The president then proceeded to deliver his address, of which an abstract is given below.

Mr. Phillips commented on the incessant labour imposed upon himself and the Council during the past year by conferences and meetings in connection with the Electricity (Supply) Bill. After a pardonable expression of gratification at the success of municipal electricity supply undertakings in generating and selling electricity more cheaply than the companies did, and in establishing themselves in a very sound financial position, he rescued the Report of the Advisory Committee on Domestic Supplies of Electricity and Methods of Charge from the obscurity into which it had been thrown by the Electricity Bill, and drew attention to several of its recommendations which needed immediate settlement, especially the question of a domestic tariff suitable for universal adoption.

A vote of thanks was moved by Mr. A. J. Howard, of Taunton, a fellow pupil at Taunton with Mr. Phillips, and was seconded by Ald. H. Leese, of Stoke-on-Trent.

Afterwards the ladies joined Mrs. Phillips and partook of light refreshments, whilst the sterner sex heard and discussed a paper by Mr. W. C. Bexon, chief engineer, Ayrshire Electricity Board, on "Methods and Capital Costs of Distribution over an Extensive Area." The author dealt with the cost of constructing and tapping extra-high-pressure transmission lines (22,000 volts) to serve an area of 1,100 square miles, the construction and costs of open-air sub-stations, underground distribution, and overhead low-pressure distribution, and the regulation of long-distance transmission lines. He expressed a preference for duplicate feeders on the same poles, the latter being of wood, and regretted that the 1926 Act did nothing to remove the difficulty of obtaining wayleaves. Where necessary, however, he used steel towers. His experience of open-air sub-stations since 1918 had been very favourable. For distribution he found 3,300-V feeders most suitable, with transformer kiosks except where much switchgear was required, necessitating the use of a brick building. In villages the cost of distribution had to be a minimum; overhead mains were the only solution, but the present regulations almost put them out of court, and urgently needed revision. He doubted whether electricity would ever be available to the whole population at 1d. a unit, unless the many regulations were relaxed, and concluded with some suggestions to that end.

After the official photograph had been taken in the Pavilion Gardens, the members dispersed for luncheon. The afternoon was set apart for a special visit to the electrical exhibition, which was housed in the Pavilion Corridors. At the invitation of the Mayor, the visitors afterwards took tea in the Pavilion Gardens.

In the evening the President, supported by the Mayor of Bedford (Ald. Gilbert H. Barford, J.P.), and the chairman and members of the Bedford Electricity Committee, held a reception at the Palace Hotel.

The programme for Wednesday opened with a paper on "Recent Developments in Power Plant Design, and their Effects on the Economy of Generation," by Mr. T. Roles, M.I.E.E., City Electrical Engineer, Bradford, and a discussion thereon; afterwards Rotarians were invited to attend a special Rotary Luncheon at the Buxton Hydro. For the afternoon a visit to the Derwent Valley Waterworks by motor coach was planned, the route lying through Millers Dale, Tideswell, and Hathersage, and returning *via* Castleton, Peak Forest, and Dove Holes.

On Thursday, Mr. H. H. Berry was to read a paper on "Electrified Homes of Great Britain and Ireland, with special reference to the Heating Question"; the afternoon was set apart for the annual meetings of committee representatives and members of the A.M.E.E. respectively, whilst members of the E.A.W. and other ladies attending the Convention were invited by Dr. and Mrs. Ferranti to visit Baslow Hall, which is electrically equipped throughout. In the evening the annual dinner of the Association was to take place at the Pavilion.

Presidential Address.

By R. W. L. PHILLIPS.

(Engineer and Manager, Bedford Corporation Electricity Department.)—(*Abstract.*)

I HAVE recently had before me a careful analysis of a large amount of data which show that municipal supply undertakings so manage their business as to be able to generate and sell at a lower cost than other supply undertakings, and, partly owing to the system of dealing with capital, they are to-day for the most part in a very sound financial position. All will agree that this is in some measure due to the versatile set of men who for the last thirty or forty years have given of their best to the industry: men who, as the necessity arose, emerged from the engineer to the business manager.

The complete accomplishment of the co-operation between the supply and electrical contracting branches of the industry is a problem which, I think, is approaching solution. This co-operation started with the agreement which led to the inclusion of Clause 48 in the Electricity (Supply) Bill, an agreement made possible by the excellent spirit evinced by all parties to the negotiations, which it is hoped will be maintained and strengthened in operating under the clause.

Another important publication that made its appearance during the year, which, had it not been overshadowed by the Government Bill, would have received much more attention, was the Report of the Advisory Committee appointed by the Electricity Commissioners on Domestic Supplies of Electricity and Methods of Charge.

All engaged in the industry are convinced that the development of domestic supply is of great importance. Consumers who are being connected to the mains at the present time in very large numbers, at a greater rate than has been known

before, are mostly residents in the smaller types of houses, which cost practically the same amount to connect as the larger ones already connected to the mains, but produce very much less revenue. The effect on the cost of supply of the revenue per service has often been demonstrated, and it must be the endeavour of all to encourage the individual consumer to use more electricity, and to do so as rapidly as possible.

A great obstacle to progress in the path of domestic electrification is the high resistance to change that is met with in the British household. We know that we can introduce into these households methods which will enormously increase efficiency and comfort as compared with present methods, but find the utmost difficulty in persuading the people to give our methods a full and sufficient trial. The Advisory Committee's Report has carefully analysed the question of domestic supply, and a detailed study will, I think, assist in approaching the difficulties which have arisen and may arise in the future.

The daily Press gave some the impression that the passing of the 1926 Act would render possible a cheap supply of electricity in all areas. In some areas it is difficult to find revenue sufficient to warrant the capital expenditure on the mains required, so that even at the moderate tariffs existing, and even if electricity cost nothing to generate, the business is often impracticable. It is evident that this fact was well to the fore during the deliberations of the Advisory Committee, as a number of the recommendations are directed towards reducing the cost of transmitting and distributing mains.

The question of wayleaves for overhead lines, in many cases, is the principal difficulty to be overcome. In rural England one has no sooner planned a nice straight line across country than it is found that, in only a few miles, there are scores of different owners to deal with, and consequently scores of wayleaves to negotiate. Each owner generally requires a different consideration for granting the privilege, and sometimes it is necessary to divert the line and so increase the cost. Provided the line does not interfere with the amenities of his land to any extent, the owner should not be in a position to demand exorbitant consideration. Within my experience, in many cases it has been cheaper or but little more expensive to put the cable underground.

Some of the points raised in the Advisory Committee's Report are taken care of by Section 48 of the 1926 Act, by which all municipalities are given powers to sell. I am able to state, on the authority of the Minister of Transport, that this Section authorises, by implication, the provision of showrooms and a reasonable expenditure on advertising and other forms of publicity work.

Perhaps the most important matter that the Advisory Committee considered was the question of a suitable domestic tariff for general adoption. The Committee examined in detail some 13 different methods, and yet was unable to select one as being sufficiently perfect for universal use. Having regard to the fact that the Commissioners have power to fix a tariff for the country, it is time that the industry made up its mind as to what it wants.

As so many methods of determining the fixed-charge portion of the tariff seem to have proved more or less successful, one could almost argue that the actual method to be adopted in any particular case is not of very great importance. If anything, the evidence in the Report leans towards the adoption of floor area as possibly the favourite method, and it is significant that floor area also plays some part in the determination of the ordinary assessable value of domestic hereditaments, but this method has some staunch opponents.

Attention is called to the fact that any alternative flat rate must be high, but I do not think it is always realised that this should refer to the heating as well as to the lighting rate. For instance, it is no use offering a two-part tariff to replace, say, a lighting rate of 6d. and a heating rate of 1d., unless the unit charge of the two-part tariff is less than 1d., otherwise there will be no inducement for increasing the use of apparatus already in use on the 1d. rate. There is a distinct difficulty in this connection when introducing for the first time a two-part tariff, especially in areas where the lighting and heating rates are low. The raising of both these charges merely to introduce an alternative tariff creates a suspicion in the minds of consumers, difficult to allay, which militates against the new tariff, and I think this difficulty has been one of the chief obstacles to its introduction.

It would be of immense benefit to the whole industry if one system of charging could be adopted throughout the country, and this benefit would be increased enormously if the unit charge could be standardised, leaving each undertaking to determine the fixed-charge factor according to the cost obtaining in the district. When national generation is established there should be no great difficulty in this. All catalogues, advertisements, and other propaganda literature would then be able definitely to state the actual cost per hour, day, week or year, of the apparatus described, irrespective of the district in which it is to be used, which would undoubtedly foster the use of all types of domestic apparatus.

Most of the matters touching upon overhead lines could possibly be settled by a conference between the Electricity Commissioners, the Postmaster-General, and the supply authorities, and I have reason to believe that this can easily be arranged by application to the Electricity Commissioners, but it should be taken in hand forthwith. A number of the improvements suggested could be settled first by agreement between certain parties, and if necessary a short Bill could be introduced to ratify them. I therefore suggest that this Association introduce into its work for the coming year the consideration of the best way of setting this machinery in motion.

Of equal importance is the question of the terms and conditions upon which a bulk supply will be available to those undertakings which are to cease generating. The terms examined so far vary in different undertakings to such an extent as to render analysis an absurdity. Most of them adopt the usual method of charging a fixed price per kilowatt of maximum demand with an added unit charge, but the prices charged vary from 15s. to six guineas per kilowatt per annum and from 0.35d. to 0.75d. per unit. Moreover, the methods of determining the maximum demand seem to be only limited by the number of undertakings. There is no doubt that this point must receive the very careful consideration of all concerned, as it is obvious that a false step may lead to a state of affairs which may seriously cripple the development of electricity supply, particularly when it is necessary to offer special rates to consumers to suit special conditions.

Many of these vital points nowadays seem to be prejudged and settled without reference to the industry concerned, and I think it is the duty of the Bulk Supply Committee to get to work as quickly as possible and take the necessary steps to formulate standard procedure.

Our hon. secretary, Mr. Alex. C. Cramb, must on this occasion be especially congratulated and thanked for bringing to a successful conclusion what has been his object for so many years, *viz.*, the securing to all municipalities of the powers to sell. It is almost entirely due to his determination and good work that this clause was secured in the 1926 Act.

Distribution over an Extensive Area.

Methods and Capital Costs.

By WILLIAM C. BEXON.

(Abstract.)

THE author pictures an electricity works supplying in its own particular township; between 20 and 25 miles away are other towns having populations of between 11,000 and 30,000, which have no electricity supply. The country intervening is sparsely populated, but there are a number of villages, an occasional large works, and a number of collieries. The paper gives details and approximate costs of supplying this large area.

Extra-High-Pressure Transmission Lines.

Underground cables at pressures of 33,000 volts and above have yet to be proved reliable, and in transmitting energy over large areas, it is almost impossible to have overhead construction throughout; telephone and telegraph wires are

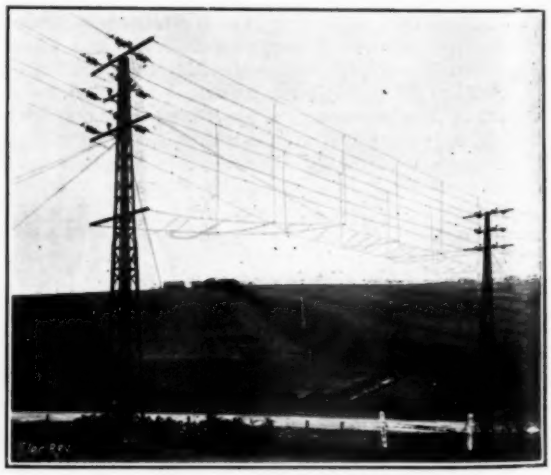

Fig. 1.—P.O. Line-Guarding System.

met with, and at these points underground cables have to be laid. The Post Office authorities may, however, agree to an overhead transmission line, provided a very expensive and unsightly system of guarding is erected. The guarding shown in fig. 1 had to be erected for the purpose of protecting only nine overhead telegraph wires.

From data available voltages of 22,000 to 25,000 are shown to be the most economical for a radius of 25 miles, and a voltage of 11,000 for a radius of 10 miles, which bears out the old rule of 1,000 volts per mile. Cables manufactured for 22,000 and 25,000 volts have proved reliable.

An engineer, in designing an e.h.p. distribution scheme over a large area—and in this paper the author is dealing with an area of 1,100 square miles—has to make an estimate of the maximum load. The transmission lines must be designed to deal with an anticipated load, and at a reasonable capital expenditure. Continuity of the supply is a very important factor. The objection to separate feeders is the high capital cost, and, in the author's opinion and experience, a duplicate feeder on the same poles is the most economical.

Six-wire line construction on "A" poles is easily effected, and at a minimum cost. The capital cost per mile of such a line, for a working pressure of 22,000 volts, erected under the latest electricity regulations, and allowing for one heavy angle, two light angles, and four duplicating straight-line poles, is as follows:—

Norwegian fir poles, 40 ft. long, insulators, &c.	£492	0	0
Copper wire No. 1/0s.	491	0	0
Erection of poles	58	0	0
Running out and hanging copper	25	0	0
Straining and binding in	31	0	0
	£1,097	0	0

Total cost per mile—say £1,100 0 0.

For a 3-wire line construction, the capital cost would be £720 per mile. Therefore for the same capacity of line the ratio is £1,100 as against £1,440 per mile. If the lines were designed for a working pressure of 11,000 volts there would be a deduction of approximately £20 per mile.

The cost of lattice masts is very much in excess of that of wooden poles. Farmers object to the concrete foundation and demand a very much higher wayleave rental. In addition, these masts require to be painted annually, and they show serious signs of deterioration in acid and salt atmosphere.

The Kay pole, fig. 2, which is made up of steel tubes, is free from rivets, bolts and nuts, but owing to the amount of land taken up by the four legs, *viz.*, 18 sq. ft., delay often occurs in obtaining wayleaves, and a considerable sum in excess of the wayleaves for an "A" pole is asked.

The most difficult factor is obtaining the necessary wayleaves. The Electricity (Supply) Act, 1926, does not give any better facilities for obtaining wayleaves than previous Acts, which are practically of no use. The farmer puts forward every possible objection. The author has found the following arrangement to work satisfactorily: the Authority pays for all damage done due to the erection of the poles, &c.; if the farmer requires a supply the Authority runs a service line into his premises free of expense to him, but he in return frees the Authority from all annual wayleaves and other expenses.

Another difficulty in connection with wayleaves is that the farmer invariably wishes as many poles as possible to be placed on the hedge line, and this is often impossible. The Road Authorities stipulate that any structure shall not be less than 25 ft. from the centre of the road. It is necessary, therefore, to place the poles in the cropping fields. Again, should the Post Office have lines running along a roadway the Lighting Authority cannot erect lines on the opposite side of the road, as the Post Office stipulates that the distance between its lines and those of the Lighting Authority must not be less than a distance equal to one and a half times the height of the highest wire, and as roads are not often of such a width the power lines have to be erected in the fields.

Unfortunately, from the revenue point of view, a farm supply is small considering the amount of capital involved in giving the supply. The author has taken at random the consumption of 73 farms, and the total consumption for 12 months amounted to 63,558 units, which gave an average annual revenue from each farm of £11 16s. 3d.

Tapping E.H.P. Transmission Lines.

A reasonably cheap method of giving a supply to a farm is by using a pole transformer; the capital cost of a 20-kVA supply under this scheme would be £150.

Fig. 3 shows a 50-kVA transformer mounted on a 4-member structure, and supplying eight farms, all situated within a radius of 1¼ miles. The type of fuse employed in this gear is merely a small fuse wire passed through a glass tube, filled up with sand and sealed at both ends. It is inserted between two horns. When a fault occurs the fuse is blown to atoms, but the cost of replacing is almost infinitesimal.

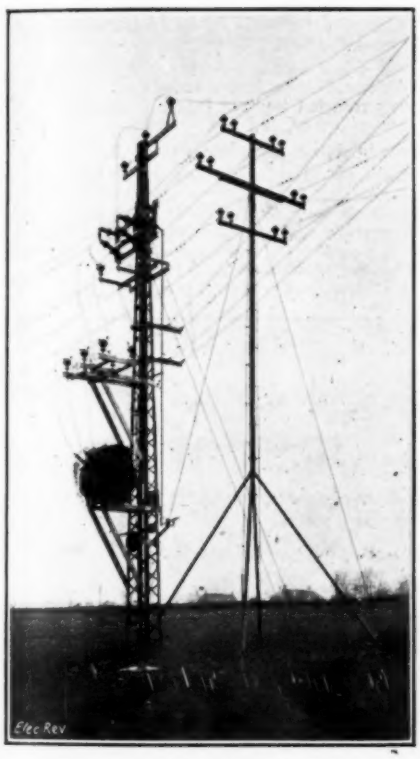

Fig. 2.—Kay Pole and Transformer.

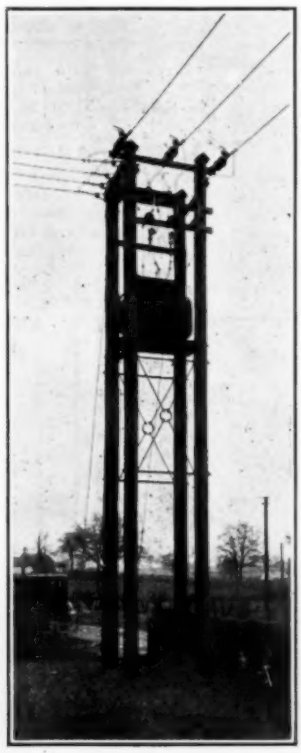

Fig. 3.—Four-Member Pole and Transformer.

Fig. 4.—Isolating Tower Station.

The same arrangement of tapping transmission lines to supply villages can be adopted. The author has had experience of this type of tapping for a number of years, and it has proved quite reliable.

In long-distance transmission lines for supplying townships it is advisable to have disconnecting points at intervals, so that should a fault occur it can be localised more readily; the isolating station and transformer station for the supply to a village can be on the same structure, fig. 4, costing, with a 200-kVA transformer, £662. The isolating switches are operated from the ground level.

Open-Air Sub-Stations.

It is advisable to make the system of supply standard in all townships and villages in the one area with a view of minimising spares, and to have the smallest amount of stock. For a town of 20,000 inhabitants 3-phase, 4-wire is the most economical system, with 415 volts between phases, and 240 volts between phase and neutral. To give a supply to consumers in townships situated 20 miles from the power station, at the same rate as rules near the power station, every possible method of minimising the capital costs must be taken.

If there is but little switchgear required, an open-air substation will suffice, but where there is to be large distribution

control from the sub station, one of the brick type would be as economical. Fig. 5 shows an open-air sub-station, 22,000/11,000 volts, 3-phase, consisting of two feeders in, two feeders out, two 1,500-kVA transformers (one of which is a spare). It is built up of "H" beams.

The total cost of this sub-station, excluding transformers, is £1,351.

The total amount of land occupied is 76½ square yards, and a minimum rental of £1 per annum is asked for. To build a brick sub-station to house the above apparatus would increase the capital cost considerably.

The chief disadvantage of the open-air sub-station is that inspection of the transformers can only be undertaken in dry weather. Nevertheless, the advantages of an open-air sub-station far outweigh the disadvantages. The author has had this type of sub-station under his supervision since 1918, and very little trouble has been experienced.

Underground Distribution.

In the author's opinion it is uneconomical to have a low-pressure feeder and distribution system in a town, owing to the amount of copper required to overcome voltage drop. A 3,300-volt, 3-phase feeder system meets practically all cases.

An approximate price per mile for supplying and laying cables (allowing a maximum voltage drop of 100 volts) for 3,300-volt cable, suitable for a route length of three miles; 6,600-volt cable, for six miles; and 11,000-volt cable for 10 miles, at a power factor of 85 per cent., is as follows (these prices do not include excavating and reinstating):—

3-core Lead Covered and Armoured Cable.

Carrying capacity in kW.	Size of cable.	Price per mile.
3,300-volt—		
500 ...	.075 ...	£1,056 0 0
1,000 ...	.15 ...	1,435 0 0
1,500 ...	.25 ...	1,906 13 4
6,600-volt—		
500 ...	.04 ...	1,122 0 0
1,000 ...	.075 ...	1,371 6 8
1,500 ...	.10 ...	1,592 13 4
11,000-volt—		
500 ...	.04 ...	1,349 6 8
1,000 ...	.04 ...	1,349 6 8
1,500 ...	.06 ...	1,481 6 8

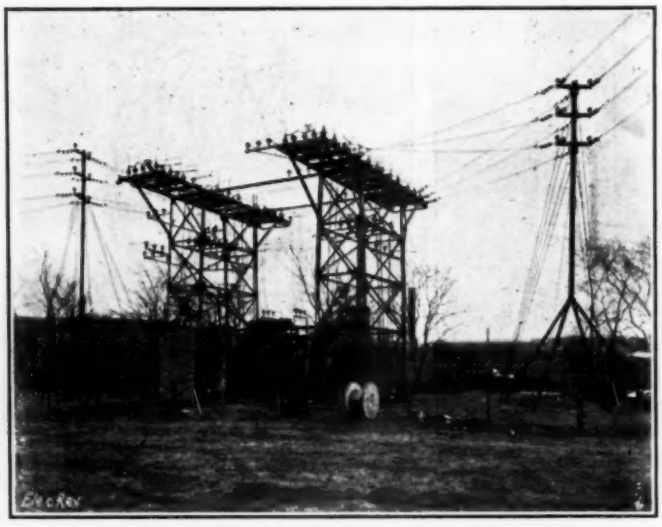

Fig. 5.—Out-door Sub-station, 22,000-11,000 V.

Fig. 6.—Simple Brick Sub-station.

The tapping of a 3,300-volt system can be done at a minimum capital cost. A 3,300-volt, 3-phase, 3-way, disconnecting pillar, and cast-iron transformer kiosk, erected on the footpath in a main thoroughfare, and housing a 100-kVA, 3-phase transformer, costs £331 inclusive.

In view of the fact that consumers are now making much more use of heating and cooking apparatus, it is advisable to have the neutral the same size as the other cores, and this adds very little to the cost.

Another advantage of the 3,300-volt, 3-phase system is that reliable motors of large size can be built for the voltage, and the switchgear (which takes up very little space) is also inexpensive. The pressure of 3,300 volts is also useful for collieries, more particularly for pumping.

The domestic supply is increasing considerably year by year, and with a system of high-pressure feeder distribution, which can be tapped at little expense, the engineer need not fear pressure drop.

A typical lay-out of a distribution system, fig. 7, is, roughly, as follows: From the main e.h.p. sub-station a ring-main is run direct through all the kiosks and back into the main sub-station. The low-pressure 4-core mains are also run, and interconnected with the various kiosks. Under this system of distribution the pressure is equalised in all the districts, and the tappings—both on the high- and low-pressure feeders—can be made when extra transformers are required.

In a small town having a population of 8,000, whose chief industry is shipbuilding, the demand from the shipyards is approximately 1,750 kW. The only other load in the area is small power, and the usual domestic load. It was found that the cheapest method would be to run an 11,000-volt feeder to the shipyard, and also to have a 3,300-volt ring-main distribution system. The 11,000-volt feeder was interconnected with a 3,300-volt ring-main by a transformer. The consumers, at their own expense, built the sub-station, and allowed the use of it for supplying other consumers in the district. This is a standard arrangement with consumers who require a special e.h.p. supply.

By having two or three pressures of supply the cost of sub-stations is increased. A sub-station capable of housing two 11,000-volt incoming feeder panels, one 11,000-volt outgoing feeder panel, one 11,000-volt transformer panel; two 3,300-volt outgoing feeder panels, and two 3,300-volt transformer panels, is a two-floor building, 16 ft. by 14 ft. by 20 ft. The 11,000-volt switchgear is of the ordinary draw-out cubicle type, and the 3,300-volt switchgear is of the ironclad draw-out type. The sub-station also contains a low-pressure distribution board and two 300 kVA transformers. The cost of the two-floor sub-station, excluding the transformers, is £1,064. Where land is difficult to obtain the two-floor sub-station minimises the difficulty.

In the case of a single-floor 11,000/3,300-volt brick sub-station, the building is 14 ft. by 14 ft. by 14 ft., with a concrete roof, and houses the following plant:—

Two 11,000-volt truck feeder switches.
One 11,000-volt transformer feeder switch.
Three 3,300-volt ironclad 3-phase feeder switches.
One 500-kVA transformer, 11,000/3,300 volts.

The cost of the sub-station complete would be £1,200.

Fig. 6 shows a simple brick sub-station which houses two 250-kVA transformers, 11,000 V.

To reduce sub-station capital costs, sheet-steel sub-stations have been developed. The capital cost of this type, of 200-kVA capacity, including h.p. and l.p. switchgear, is approximately £600. The approximate dimensions are 8 ft. 6 in. by 7 ft. 6 in. by 7 ft. The local authority may object to a construction such as this being erected in a residential or shopping area, but this type of sub-station will be useful in some areas.

In the author's opinion it is somewhat absurd for the Authority to have a set of fuses, and the consumer a similar set within three feet of them. Why one set would not suffice it is difficult to understand.

Overhead Low-Pressure Distribution.

Distribution in small villages is an entirely different matter from distribution in towns. There are no large shops and practically no power. The shops are closed early, and the consumption is exceptionally small. The cost of distribution must, therefore, be at the minimum. Overhead distribution is the only solution, but the present regulations almost put out of court overhead distribution in some small villages, and the sooner these are altered the better for the supply industry and the consumer.

For many years overhead tramway systems have been in existence working at 500 V. There are no rules stipulating that an earth wire must be used in case the wire should fall, and the number of serious accidents is practically negligible.

Some of the conditions stipulated in the Electricity Com-

missioners' Regulations, 1923, particularly Clause 13, are unnecessary, and the Post Office will not allow bare wires over its own lines unless the Lighting Authority agrees to pay for alterations and protection.

The cost of overhead distribution, 3-phase, 4-wire, using No. 2/0 copper, is approximately £600 per mile. The cost of an overhead service, using No. 6 copper, is £2 12s. (twin), and £5 3s. (4-wire).

To minimise the cost the author stipulates that the work by the Authority shall terminate on the chimney of the building; from this point the consumer, at his own expense, must, through his electrical contractor, provide and erect the necessary wiring from the overhead line.

The following particulars are of a village having a population

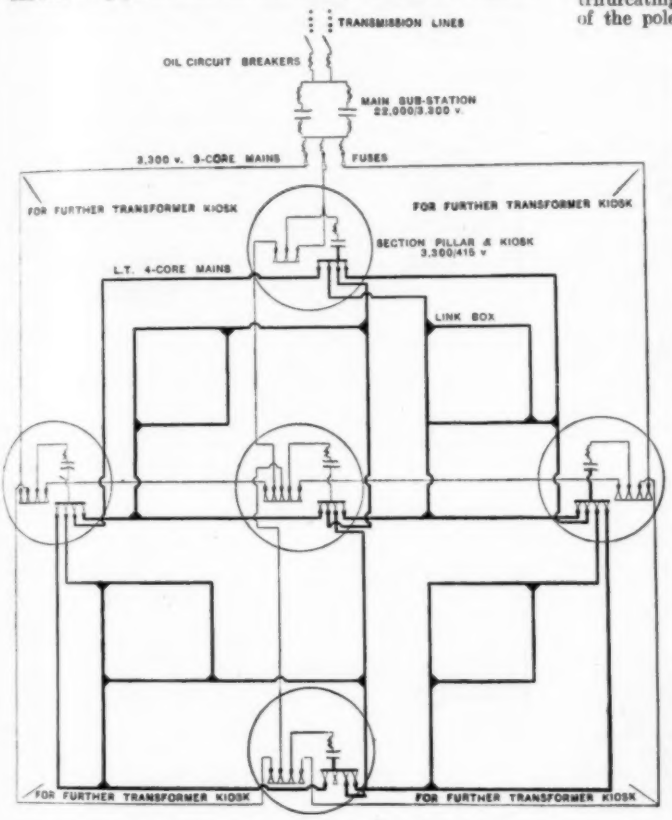

Fig. 7.—Typical Layout for h.p. and l.p. Systems.

of approximately 4,000. The total length of distribution through the streets was 2 miles 1,600 yards, and the capital cost in giving the supply was £2,924, excluding meters, made up as follows:—

One open-air sub-station, complete ...	£122	0	0
One 100-kVA transformer	242	0	0
Overhead distribution	1,810	0	0
Services	750	0	0

At the end of the first year the number of consumers was 254, and the revenue £732, an average per consumer of £2 17s. 8d. Had underground cable been adopted in place of overhead lines the capital expenditure would have been £4,750, and with reinstatement costs, a further sum of £1,000.

Quite a different type of village consists of practically one street. There are 50 consumers, and the total consumption for 12 months was as follows: Lighting, 10,723 units; heating, 20,457 units; power, 5,666 units.

The revenue was £497, an average of almost £10 per consumer.

Regulation on Long Transmission Lines.

Pressure drop on an e.h.p. line is not so serious a question if the whole of the lines are on the ring system, but to supply an area as is suggested in this paper the undertakers cannot afford to interconnect all their lines almost at the commencement of the scheme, but must wait until the lines are earning a reasonable revenue, and also, if possible, until the interconnecting lines can be used, not only as part of the ring system, but as feeders; *i.e.*, it is not advisable to run the interconnecting lines until there are a sufficient number of consumers *en route*.

An induction regulator, situated in the power station, having a 10 per cent. buck and boost, will give ample voltage regulation to allow for the voltage drop on the transmission line. A double-wound regulator does not seriously affect the power factor; its efficiency is approximately 95 per cent.

Increasing the pressure at the power station to give a correct voltage at the farthest point means that the pressure at less distance from the station is high, but this condition can be obviated by installing tapping transformers in the sub-stations *en route*. With the latest type of tapping switch, operated from the outside of the tank of the transformer, it is a simple matter to alter the tapping. The transformers should have tappings giving a range of variation of not less than plus or minus 5 per cent.

Manufacturers have now put on the market an automatic regulating-type transformer which will be of great service in keeping the correct pressure in the outer districts.

Overhead Line Troubles.

One of the greatest weaknesses in overhead lines is the trifurcating boxes. These were usually erected at the top of the pole, and it was impossible to inspect them until the

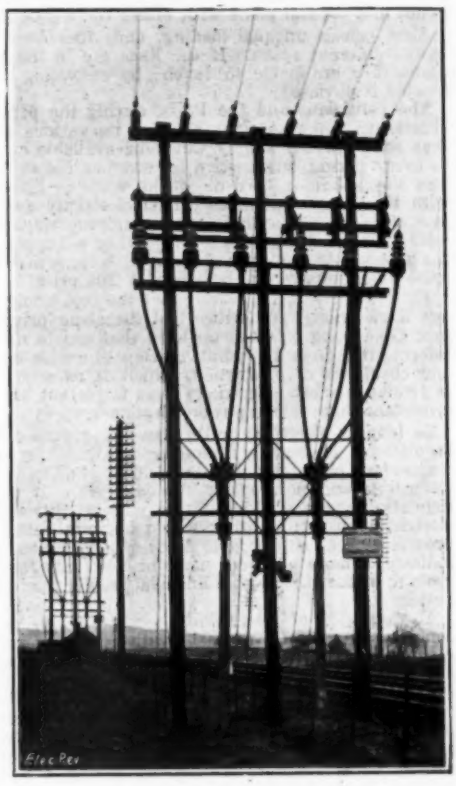

Fig. 8.—22,000-V Pole with special Dividing Boxes.

lines had been made dead. If a fault occurs on one of the boxes on a 6-wire line then both lines have to be shut down until the box is repaired. The author, in conjunction with one of his assistants, designed and patented a box which has minimised these troubles. Instead of the dividing box being erected at the top of the pole, a small sealing end box, terminating the underground cable, is erected 10 to 12 feet up the pole. Special lead-covered cambric tails are run from this sealing box to the top of the pole, and the cables terminate in porcelain sealing ends, fig. 8. This type of box has been in use for the last four years, and no breakdown has yet occurred. The boxes can be inspected easily, and should one break down it can be repaired without curtailing the whole of the supply on the 6-wire line.

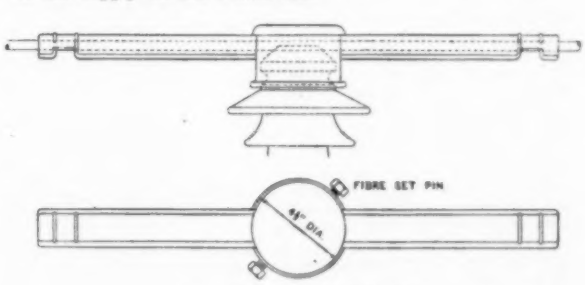

Fig. 9.—Porcelain Bird Guard.

Lightning surges give rise to flash-overs on the line, and when once established will be maintained by the power from the alternator. The flash-over takes place usually where the clearances to earth are the least. This is minimised by the use of aluminium lightning arrestors, which, preferably, should be at both ends of the lines.

The failures of insulators would be comparatively few provided the insulators were those manufactured in this country and recommended by the manufacturers for the specific duties, and not as recommended by any association.

Probably the greatest number of failures of overhead transmission lines are caused by crows. Fig. 9 shows a bird guard which should overcome this difficulty. It is made of porcelain and is in three pieces. It can be erected quickly.

Another disturbance caused by crows is when a large flock rests on the entire length of a span; immediately one starts the whole flock flies off, and invariably a short circuit takes place. Sometimes the birds themselves cause a short circuit, and sometimes the lower wire swings and touches the higher one immediately the weight has gone off the wire. To overcome this difficulty the wires should not be in a direct vertical plane. If the middle cross-arm is 4½ ft. longer than the top arm and 3½ ft. longer than the lower arm, the middle wire is not in a vertical plane with either the top or the lower one.

Sleet causes unequal loading, and, therefore, unequal sag in the different spans. If the lines are in the same vertical plane they are liable to touch; by extending the arm this trouble is obviated.

The politicians and the Press, during the period when the Electricity Bill was going through its various stages, stated that an electricity supply would be available at 1d. per unit to every person irrespective of whether his or her residence was situated in a town or in the wilds of the country, but, with the many regulations which electricity authorities have to contend with—the first cost in obtaining wayleaves, coupled with the initial capital cost in giving a supply of energy—the author is not so optimistic as to believe that the day will come when supply will be given at this price.

There is no doubt, however, that the cost would be decidedly less if electricity authorities had the same privileges as the Post Office, and I fail to see why that should not be so, considering that from the points of view of health and cleanliness and cheapness of production, which is necessary to compete in foreign markets, electricity is as important as, if not more important than, telegraphs or telephones.

So long as electricity authorities are governed by so many regulations, and meet innumerable difficulties in obtaining wayleaves, electricity in the outlying districts and small townships will not replace the coal fire. If, however, the regulations were minimised, and more facilities given to the electricity authorities, they would be in a better position to provide a cheap supply; and as the figures given in this paper indicate, if more use were made of electricity for heating and cooking in the villages, the financial results would be decidedly better.

The question of interlinking power stations is now being considered by the Government with a view of reducing generating costs. Many collieries have their own stations, and are able to generate at very low cost owing to the fact that they burn a fuel of a very inferior quality. If these stations, which often have ample spare plant, were connected to the public transmission lines, it would tend to reduce the capital and the working costs, and make full use of a fuel which cannot be sold. Furthermore, by taking a supply from a colliery, or any other private source, an area can be developed until the revenue is sufficient to warrant the extension of the transmission lines to it.

The revenue figures given in this paper are based on the following charges: Lighting, 6d. and 5½d. per unit; heating and cooking, 1½d. per unit. Alternatively, 10 per cent. of the assessed value of the house per annum, plus 1d. per unit for all units consumed.

In this paper the author has mentioned hindrances and difficulties in giving a supply over large areas; the following suggestions to overcome these are made, all of which should result in cheapening the electricity supply:—

(*a*) Statutory rights should be given to electricity authorities to erect transmission lines through agricultural country, after submitting plans to the Electricity Commissioners. The present method of giving notice, and later having an inquiry, causes considerable delay and should be abolished.

(*b*) A statutory wayleave rental of 1s. per pole per annum to the landlord should be made compulsory throughout the country.

(*c*) A statutory wayleave rental of 1s. per pole per annum in grass, 1s. 6d. in corn, and 2s. 6d. in green crops should be given to the tenant.

(*d*) Statutory powers should be given to electricity authorities to erect section boxes and kiosks in public thoroughfares.

(*e*) Any expenses incurred by an electricity authority in removing works, *viz.*, underground cables, transmission lines, section boxes, &c., on account of alterations to a street, &c., by the local authority should be repaid to the electricity authority by the local authority.

(*f*) Electricity authorities should be relieved of all rates and taxes on transmission lines in areas from which no revenue is derived.

(*g*) The rule of paying to the Post Office Authorities a proportion of the cost of laying its works underground when it is second-comer should be cancelled.

(*h*) The Post Office condition that power lines must be not less than a pole-and-a-half distance from telegraph lines should be cancelled.

(*i*) Facilities should be given to electricity authorities to erect poles along the roadside.

The I.M.E.A. Exhibition.

AS in previous years, an exhibition of electrical apparatus is being held this year in connection with the Convention at Buxton. It is arranged in the Pavilion, where about 30 stands are to be seen. Domestic apparatus forms the predominant feature of the display, almost every firm showing some sort of heating or cooking appliances.

The show of METRO-VICK SUPPLIES, LTD., is particularly interesting. A new type of "Cosmos" boiling plate and a new "Cosmos" cooker are to be seen, in addition to a complete range of domestic electrical appliances, including new 1- and 3-kW flat-bar radiant fires which have been produced to meet the demand following the introduction of the 2-kW type last year. "Cosmos" fans, the "Emvee" lampholder, and a range of Harcourt electric light fittings are also included in this exhibit.

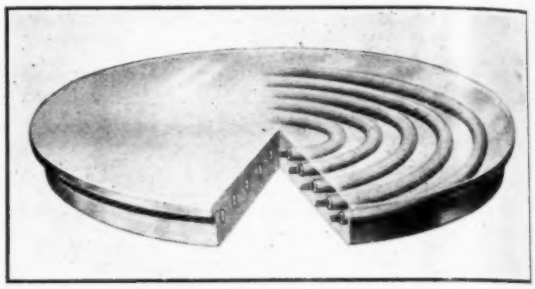

Fig. 1.—New Boiling Plate; Cast-in Elements.

Continued investigation by the M.-V. research department into the possibilities revealed by the discovery of crystalline magnesium oxide has resulted in a further improvement in the construction of the elements for the "Cosmos" plates.

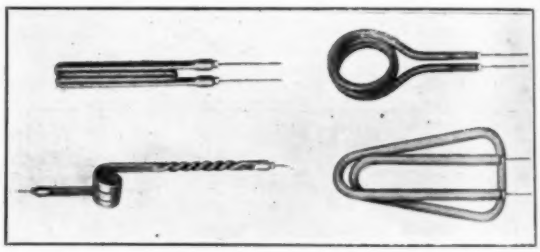

Fig. 2.—Twisted Tubular Elements.

The new plate is manufactured by a process which ensures the building of a complete wall of crystalline magnesium oxide around and in close contact with the heating element, but it has the distinct and important advantage that there is an appreciable reduction in weight as a result of the adoption

Fig. 3.—New "Cosmos" Cooker.

of cast-in tubular elements, fig. 1; consequently the stored heat is less than in the case of the previous type of plate,

Electrical Review, June 18th, 1926, p. 935. In order to minimise the space and weight it was found advantageous to insert the magnesium tube containing the heating element into an outer metal tube or covering before converting the magnesium into crystalline magnesium oxide. Perfect thermal conduction is claimed to be ensured between the heating coil and the inner surface of the outer metal tube through a layer of even thickness of electrical insulation around the element coil. It is claimed that a tubular element constructed in this fashion can be formed, coiled, twisted or flattened into any shape, fig. 2, without damage to the insulation.

A new self-contained table stand boiling plate is mounted

Fig. 4.—Electric Washing Machine.

on a black enamelled stand, with a nickel-plated top plate, fitted with a three-heat rotary pointer switch and fuses. It can be supplied either with a 6¼-in. boiling plate, 1,200 W, or an 8¼-in. plate, 2,000 W.

The latest addition to the range of "Cosmos" cookers is the new small model, fig. 3, which is specially designed to meet the increasing demand for an efficient cooker for small houses, bungalows, flats, and so on. The overall dimensions are 22 in. by 17 in. by 33 in. high.

The oven is fitted with a removable single-unit lining. The elements are placed at the top and bottom of the oven. The grill is situated in the centre of the top element of the oven. This cooker is supplied in two models, one with one 8¼-in. boiling plate, the other with a 6¼-in. and a 4¼-in. plates.

Messrs. Burnley Components, Ltd., are showing a new electric washing machine, fig. 4, which they have designed specially for hire-purchase and hire schemes. It is constructed of a cypress wood tub in which a dolly is rotated to and fro by means of a motor, the dolly making 110 half-strokes per minute. A rubber roller type wringer is fitted to the machine, and the usual reverse movements are provided for. The washer is mounted on castors, and is easy to move about. A folding tub rack is fitted on the side to permit a basket or another tub to be placed within easy reach. The

Fig. 5.—An Electric Wagon.

makers are also showing the "Burco De Luxe" wash boiler, together with their housing scheme type of boiler.

The electric vehicle shown in fig. 5, which is being demonstrated at Buxton, is being exhibited by Messrs. Electricars, Ltd., by whom it was designed and built chiefly for house-refuse collection, but it may be used, with suitable bodies, for general purposes.

An unusually light chassis construction has been adopted, and also a light battery housing, driver's cab and shield. The makers guarantee the vehicle to carry an overload of 25 per cent. The normal capacity of the vehicle is 30 cwt., and its gross weight, when fitted with an all-steel tipping body and the electrical gear, is such that the road tax is only £13 per annum.

(To be continued.)

Electrical Imports of Spain.

THE following figures, showing the imports of electrical goods into Spain in 1926, are taken from the recently issued trade statistics. The totals for 1925 are given for purposes of comparison, and notes of increases or decreases added.

	1925. Quantities. 100 kg.	1926. Quantities. 100 kg.	Inc. or dec. 100 kg.
Dynamos, motors, transformers, switchgear, &c.—			
Total	52,902	41,985	−10,917
From Germany	14,817	11,348	− 3,469
„ United States	10,163	4,456	− 5,707
„ France	7,300	9,690	+ 2,390
„ Great Britain	5,311	2,389	− 2,922
„ Sweden	2,392	3,469	+ 1,077
„ Belgium	2,388	1,025	− 1,363
„ Switzerland	1,851	6,811	+ 4,960
Self-contained generating sets—			
Total	3,397	2,285	− 1,112
From Germany	1,334	613	− 721
„ France	1,264	469	− 795
„ Great Britain	348	479	+ 131
„ United States	154	94	− 60
Switchboards—			
Total	1,332	977	− 355
From Germany	383	206	− 177
„ United States	274	136	− 138
„ France	240	425	+ 185
„ Great Britain	173	76	− 97
Electrical fittings (switches, lampholders, &c.)—			
Total	7,810	5,408	− 2,402
From United States	2,981	1,281	− 1,700
„ Germany	1,816	1,490	− 326
„ Great Britain	1,219	488	− 731
Electrical measuring instruments and parts thereof—			
Total	1,991	1,558	− 433
From Germany	1,243	824	− 419
„ France	251	218	− 33
„ Switzerland	379	328	− 51
„ Great Britain	44	5	− 39
Stoves, heaters, cookers, irons, &c.—			
Total	568	408	− 160
From Germany	157	68	− 89
„ Switzerland	230	139	− 91
Accumulators, dry batteries, and parts—			
Total	7,618	5,527	− 2,091
From Denmark	1,672	1,130	− 542
„ Germany	1,121	936	− 185
„ Great Britain	1,036	537	− 499
„ United States	966	1,451	+ 485
„ France	917	975	+ 58
„ Norway	501	38	− 463
Wires and cables—			
Total	13,037	31,411	+18,374
From Great Britain	4,926	21,005	+16,079
„ Germany	4,293	3,113	− 1,180
„ France	1,542	5,652	+ 4,110
„ United States	880	16	− 864
Incandescent electric lamps—			
Total	666	818	+ 152
From Holland	411	731	+ 320
„ Great Britain	77	12	− 65
„ France	5	28	+ 23

	1925. Quantities. 100 kg.	1926. Quantities. 100 kg.	Inc. or dec. 100 kg.
Telegraph and telephone switchboards and apparatus—			
Total	3,647	5,818	+ 2,171
From France	979	662	− 317
„ Belgium	655	3,932	+ 3,277
„ Germany	598	141	− 457
„ Great Britain	534	267	− 267
„ United States	397	372	− 25
„ Sweden	355	340	− 15
Electric mercury vapour lamps, searchlights, &c.—			
Total	82	57	− 25
From United States	33	8	− 25
„ France	12	15	+ 3
Arc lamps and parts, &c.—			
Total	15	58	+ 43
From Germany	10	11	+ 1
„ France	3	16	+ 13
„ Holland	1	—	− 1
Carbons, other electrodes, &c.—			
Total	3,486	5,378	+ 1,892
From United States	1,181	2,432	+ 1,251
„ Great Britain	1,002	742	− 260
„ Germany	773	769	− 4
„ France	44	957	+ 913
Insulating tapes, fabrics, and tubes—			
Total	8,159	4,750	− 3,409
From United States	4,906	3,944	− 962
„ Germany	3,127	212	− 2,915
„ Great Britain	22	16	− 6
„ Switzerland	13	8	− 5

Conditions in Switzerland.

Electrical Manufacturers Cut Prices.

A REPORT on the economic and financial conditions in Switzerland, dated February, 1927, has been published by the Department of Overseas Trade through the Stationery Office (1s. 6d. net). It was prepared by Mr. R. A. C. Sperling, C.B., the British Minister at Berne, who says that the hopes of improvement during the past year were not fulfilled. The home market was flooded with cheap foreign goods, while Swiss producers were forced to accept unremunerative prices to keep their hold on foreign markets. Among the adverse factors were the British coal dispute, which curtailed this country's purchasing power; the fall in the Latin exchanges; and the incidence of the new British and German tariffs instituted in 1925. Half of the introduction is devoted to advice to British traders with regard to the Swiss market. It is again pointed out that openings certainly exist for British goods, but certain "trade points" must be attended to. Briefly, these are as follows:—Adaptation of goods to local requirements; through quotations, either f.o.r. duty paid or c.i.f., and in Swiss francs, should always be given if possible; correspondence should be in French, or, if possible, in German, in cases where German is employed; catalogues and lists should be in French or German, and the metric system should be used; resident agents should be employed, and separate agents for the German and French-speaking parts are desirable; travellers with a good knowledge of the two languages should be sent out frequently; and the desirability of advertising should not be overlooked.

Electrical Industry and Foreign Trade.

As in the machinery industry, there was a falling off in the electrical industry during the latter part of last year. The orders placed by the Federal Railways on account of electrification were an important factor in increasing the year's turnover. The present electrification programme, however, will be completed in 1928, and many manufacturers are now looking about for a substitute for this source of orders. There was a smaller demand for standard apparatus such as small dynamos and motors, transformers, switchgear, &c., and this trend was sufficiently pronounced to create misgivings as to the near future. The policy of Swiss manufacturers was towards further price reduction, notwithstanding unfavourable local manufacturing conditions, in order to meet keen foreign competition. The high quality of Swiss electrical products is a great asset, states Mr. Sperling, which opened the road in 1926 to not a few technical successes, the financial side of which was jeopardised in many cases by price-cutting.

The imports of electrical equipment during 1926 totalled 2,043 tons, valued at 16 million fr., an increase of 365 tons as compared with 1925. They consisted principally of accumulators (380 tons), telegraph and telephone apparatus (433 tons), insulators (296 tons), dynamo-electric machines (410 tons), and unspecified apparatus (491 tons). The main sources of supply were Germany, France, Italy, Great Britain, and Belgium. The exports consisted of 7,649 tons of dynamo-electric machinery, valued at 27 million francs, which went to Spain, France, Germany, Brazil and other South American countries, the Dutch Indies, &c.; and of 2,134 tons of apparatus (chiefly meters and unspecified goods), valued at 24 million francs, sent to France, Belgium, Great Britain, Germany, Holland, Czecho-Slovakia, Argentina, &c.

Water Power Development.

At the end of 1925 the rating of hydro-electric plant actually installed was 1,859,000 h.p., and during last year a further 41,000 h.p. was put into service, while 320,000 h.p. was under construction. It is stated that the present development represents about one-fourth of the total water-power resources of the country. The largest works under construction are a railway power station of 115,800 h.p., and one of 100,000 h.p., being built by the Oberhasli (Bernese Oberland) Power Supply Co.; the former was to be completed this spring, and the other is expected to be finished in 1929-30. The output of Swiss electricity works during 1926 is put at about 4,000 million kWh, or about 80 per cent. of the maximum available output. Of this about 775 million kWh was exported, and a similar amount used in the electrochemical and metallurgical industry, while about 200 million kWh was consumed for traction purposes. Exports of electrical power are being looked upon as an increasingly valuable source of national revenue, and the steps taken by the Federal authorities to bring about a more healthy state in export conditions are now bearing fruit. Contracts on an exchange basis were concluded in 1926 by some power companies for the export of surplus summer output, and the import in winter of power produced by "thermic" stations abroad. The annual power consumption is stated to be about 1,000 kWh per head of the population.

Railway Electrification.

The bulk of the work carried out on the Swiss Federal Railways during the past year consisted of electrification and the reconstruction and improvement of stations and track equipment. With the growth of motor transport competition and heavy wages and salaries, the financial situation is giving cause for anxiety and expenses are being cut down all round. The 1927 Budget allowance for electrification, &c., has been reduced by about 17 per cent. as compared with 1926; the actual sum allotted to electrification is 29.9 million francs; 22.5 millions is allotted for the purchase of electric locomotives and 5.3 millions for motor coaches. In January last the Federal Railways operated 1,053 km. of electrified normal gauge lines, 138 km. having been opened to single-phase electric traction in 1926-27. A further 229 km. was to be completed by last month (May), and by the end of the year another 205 km. was to be put into operation. The railways have at present about 280 electric locomotives and 25 motor coaches.

Communications and Broadcasting.

The Swiss administration concentrated most of its activities on the development of the telephone system, which at the end of 1926 served 161,689 subscribers with 210,484—an increase of 7,946 subscribers and 10,278 lines since 1925. Numerous inland trunk services, mostly underground, were put into operation in 1926, and several new international connections were established. Direct communication, by means of three circuits, was to be opened between London and Switzerland this spring. Automatic exchanges with an ultimate capacity of 10,000 lines were completed at Berne and Basle, while two similar exchanges are being installed at Zurich. Automatic sub-exchanges and satellite exchanges are also being erected at various points. Telegraphic traffic continues to decrease and several inland lines were put out of circuit in 1926; two new international lines were opened, however.

New broadcasting stations were opened at Berne in November, 1925, and Basle in June, 1926, thus bringing the total for Switzerland to five stations. The Lausanne station was re-equipped and improved in 1926. At the end of the year there were 51,194 licensed receiving sets; the increase since January was nearly 18,000. The stations at Berne, Basle, Geneva and Lausanne are now working together, the programme of each of these stations in turn being relayed by the others. The Swiss Marconi Company's station at Berne-Muenchenbuchsee dealt with more than 500,000 telegrams in 1926, *i.e.*, an increase of over 100,000 since 1925. A short-wave transmitter will be added shortly to the two high-speed and one broadcasting transmitters already installed.

Swiss Hydro-Electric Development.

According to the Swiss Press, at the end of 1926 the hydro-electric development of the country amounted to 1,867,000 h.p. Of this total 46 per cent. was developed by private undertakings, 17 per cent. by local authorities, 26 per cent. by Cantonal and other authorities, and 11 per cent. by the Swiss Federal railway authorities. The important new plants completed during last year included the Ober-Ems station of the Illsee-Turtmann Gesellschaft and the Reichenbach station of the Reichenbach Elektrowerke Gesellschaft of Meiringen. New stations in course of construction and extensions to existing stations will, when completed, bring the total capacity of hydro-electric plants up to 2,241,000 h.p.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Electric Welding Plant.

An electric welding plant which has recently been shipped to Ceylon, and which will be used for track-repair work on the Columbo tramways, has some unusual features. The set, fig. 1, was built by the PARSONS OIL ENGINE CO., LTD., Town Quay Works, Southampton, in conjunction with the EQUIPMENT & ENGINEERING CO., LTD., Norfolk Street, Strand, London, W.C.1. It comprises a standard 14- to 16-h.p. Parsons

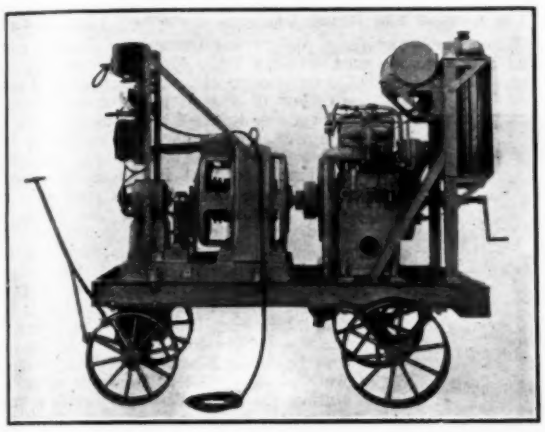

Fig. 1.—Electric Welding Set.

petrol engine, 1,000 r.p.m., fitted with a fuel tank and radiator, directly coupled to a welding generator and exciter, the whole outfit being mounted upon a welded-steel frame. The generator has a differential compound winding of an unusual design. An adjustable divertor path for the series winding is provided, and consists of an externally placed high-inductance electro magnet. Upon striking the welding arc the bulk of the heavy current is forced round the reverse series turns upon the generator and the open-circuit voltage descends much quicker than with the usual control of tapped series turns. The advantages claimed for this control are greatly reduced strain upon the plant generally, a much more flexible welding arc, and less liability of the metallic electrode to adhere to the work. The complete switchgear is mounted upon the iron uprights above the exciter and contains all the requisite instruments to control the plant, including an adjustable air-cooled reactance with a laminated core.

A Tropical-Climate Fan.

A recent production of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is the pulsating ceiling fan, fig. 2, for use in tropical climates, which is claimed to not only keep the air circulating freely, but, in

Fig. 2.—Pulsating Ceiling Fan.

addition, to deliver an intermittent volume of cooling air every five seconds, in a similar manner to the old-fashioned curtain punkah. This effect is brought about by a system of gears which varies the pitch of the blades as the fan rotates. The intermittent draught allows the body to perspire between the cooling periods, thereby inducing a healthy physiological effect.

The motor is of the semi-enclosed induction type, fitted with a ball thrust bearing running in oil, and the windings are specially insulated. The fan is claimed to be practically noiseless. The loading is from 120 to 125 W on voltages between 100 and 250, single-phase, 50 cycles. The three specially designed blades are made of aluminium-sheet formed into a definite contour which, it is claimed, ensures the minimum of slip and gives the highest possible volumetric efficiency. The sweep of the blades is 60 in. and the speed 190 r.p.m. The total weight is 57 lb., and the length of the down rod is 60 in. A standard finish of white enamel and nickel plate gives a very pleasing appearance. The blades are frosted to prevent flickering while rotating.

Electrically-operated Switchgear.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, London, S.E.7, have recently completed a number of electrically-operated oil circuit breakers, for use in a large London traction sub-station, which present a number of interesting features. They are designed to carry 300 A at a working pressure of 11,000 V, with a guaranteed rupturing capacity of 300,000 kVA. Each breaker consists of three single-pole units, mechanically coupled. Fig. 3 shows a breaker with the tanks removed; it will be seen that there is no operating mechanism near the terminals, which enables large clearances to be obtained without unduly increasing the overall dimensions. The fixed contacts are insulated with porcelain, and the moving blades by means of moulded micanite. The con-

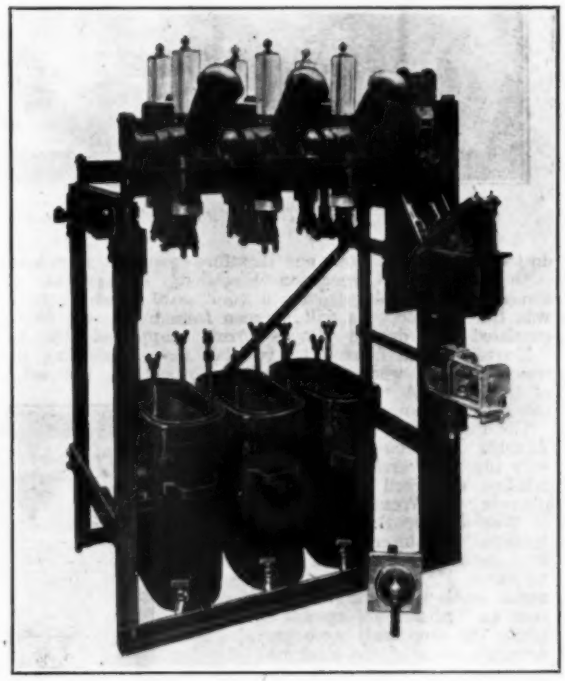

Fig. 3.—Electrically-Operated Circuit Breaker.

tacts are of the timed multiple-break type, made under license from the Electrical Research Association. The arcing fingers are of large thermal capacity and in pairs, one finger of each pair being on either side of the moving blade; they are so arranged that the contact pressure is increased by electro-magnetic effect under fault conditions. The fingers part at different points of the current wave, thereby increasing the possibility of one pair opening near the zero point of the wave when conditions for breaking the arc are more favourable than at other points of the cycle. The operating mechanism is of the solenoid type, governed by a contactor operated from the control switch. The contactor takes the control of the breaker out of the hands of the operator as soon as the control switch is closed, and ensures that the time interval before the breaker closes is constant. This time interval is small, due to the speed of operation of the solenoid mechanism, and synchronising is thereby simplified. The contactor switch for the solenoid has four breaks in series and avoids the usual dash-pot time lag, which is very indefinite in operation and requires constant attention. The mechanism is free to trip under fault conditions at any point of the travel after the arc tips touch, but "pumping" is impossible. Baffled vent pipes prevent oil throwing, and there is a large air cushion above the oil surface. Accelerating springs give a quick break, shock and rebound being absorbed by an oil dash-pot buffer.

A Window-Dressing Competition.

Effective "Hoover" Displays.

WE have received from MESSRS. HOOVER, LTD., a report upon the results of their 1927 window-dressing competition, together with photographs of the prize-winning windows. The competition entries were thoroughly representative of all branches of the "Hoover" dealer connection—large departmental stores, electricians, furnishing houses, hardwaremen, &c.

A very beautiful display arranged by Messrs. Bacon and Curtis, Ltd., of Bournemouth, took the first prize. In this, the connection between spring and the "Hoover" was the theme. The floor of the window was covered with turf, from which sprang "a host of golden daffodils," while overhead was a bower of blossoms creating the real vernal atmosphere. On one side of the window stood an unobtrusive "Hoover," and the display was completed by a series of neat cards and window posters. We regret that the photograph does not do justice to the window, and therefore cannot be reproduced.

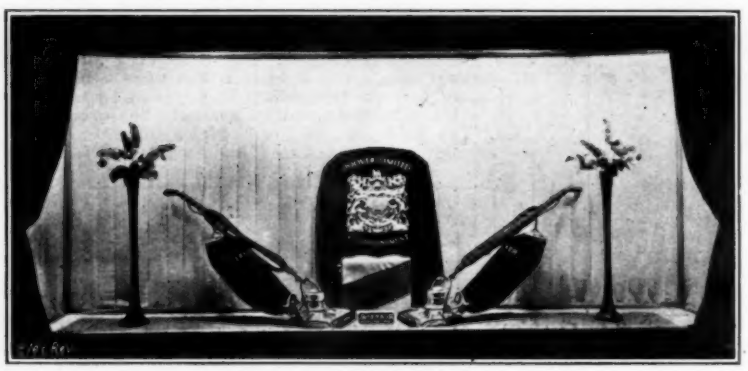

Fig. 1.—The Bradford Electricity Department's Display.

The Bradford Corporation Electricity Department was awarded the second prize for a window of which simplicity was the keynote. As will be seen from fig. 1, the display consisted of draped Royal Arms supported by two "Hoovers," and flanked by two tall vases containing lilac sprays, which were just sufficient to suggest the season of the year. A white background and concealed lighting did the rest.

The third prize was taken by Messrs. Arnolds, Ltd., Great Yarmouth, for a very ingenious arrangement. A latticed window contained a central sheet announcing "A Wonderful New Invention of War—Captures a Million Prisoners a Minute." For intervals of a few minutes throughout the day this sheet was raised to show a "Hoover" and its accessories, cards explaining that the reference to "prisoners" applied to germs. Inside the shop seats were provided for demonstrations of the machine.

A more elaborate entry was that of Messrs. Walker Bros., Birmingham, who took the fourth prize for the window depicted in fig. 2. The *pièce de résistance* was a "Hoover" in a blaze of glory and an announcement that "The 'Hoover' brings Sunshine to the Home." In the rear six cards dealt with six points regarding the cost and virtues of the cleaner. In the two side panels and the outer windows further examples of the machines appeared, and the whole assembly was well lighted, giving the utmost value to it.

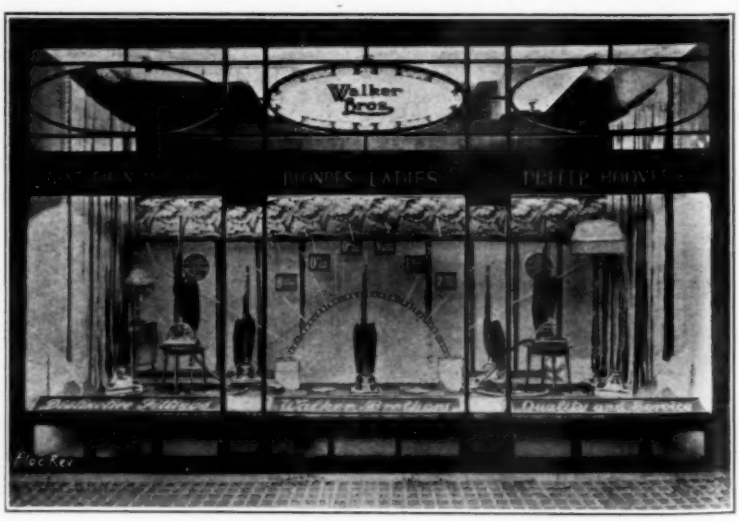

Fig. 2.—Messrs. Walker Brothers' Window.

Consolation prizes were awarded to Messrs. Ray & Miles, Ltd. (Liverpool), the Northampton Electric Light and Power Co., Ltd., the Negus Electrical Co. (Cambridge), Messrs. John Parnes and Co., Ltd. (Finchley Road, N.W.), and Messrs. Flashman's (Folkestone).

More attention is now being given to the necessity of making an effective display in the shop window. It is remarkable how excellent a show can be made in a small space when proper attention and ingenuity are brought to bear upon the problem. Some windows contain a mass of material which has been allowed to fall together in more or less chaotic state. Instead of arresting the attention of possible purchasers, it is apt to weary—even to annoy! A few things well shown are sometimes better than a thousand. They make the people think—they make them talk, both preliminaries to buying! Such examples as those dealt with above show how it can be done. While large stores and contractors with big windows and spacious premises can afford to employ skilled experts to display their wares to best advantage, smaller businesses have to make the best they can out of the limited resources that are at their command, but it is wonderful what the "small" man or woman and one assistant can do by careful and artistic planning after a critical or interested inspection of the windows of other traders who are great on the point of display.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The London and Home Counties Electricity (No. 2) Bill.

When the proceedings before the Committee dealing with this Bill were resumed on May 24th, Mr. WROTTESLEY, K.C. (for the Barnes U.D.C.) questioned Mr. Rider, suggesting that in view of the proposal of the London Power Co. to erect a station adjacent to the area, there was no necessity for the Joint Electricity Authority's projected station; and that if the latter station were erected there was a possibility of its being unremunerative. Mr. Rider replied that the station would not be erected until there was practically an assured load; he believed the North Metropolitan Co. would take a good supply. The Chairman intervened to remind Mr. Wrottesley that the Committee was guided to a great extent by the fact that the Electricity Commissioners were satisfied that at least one riverside station in the West of London was necessary. Counsel replied that he aimed at showing that only one station was necessary. Mr. Rider agreed that the Authority would not be able to supply the London Power Co.'s customers, except by agreement with the company, but there would be a linking up with the company and reciprocal supplies. The western part of the Authority's area could be supplied more economically from Chiswick than from Battersea. It was important to look very far ahead; he did not anticipate any deficiencies in the meantime, however. Mr. Rider admitted that in his report last year he did not have the erection of a large station at Battersea in mind. The effect of that station would be that the development at Chiswick would not be so rapid as would otherwise be the case. He pointed out, however, that the development of the demand was more rapid than had been anticipated. Mr. WROTTESLEY suggested that it would be better if the Chiswick station were erected some years hence, but Mr. RIDER said that if the opportunity of acquiring the site was not taken it might be lost altogether; he could not agree that an alternative site at Hurlingham would be as suitable.

The Hon. EVAN CHARTERIS, K.C., for the London Power Co., said that in view of Mr. Rider's evidence as to the desirability of constructing the stations at Battersea and Chiswick concurrently he did not propose to cross-examine him.

The Committee adjourned until the following day, when Mr. RIDER, in reply to questions, said that he did not think that it would be cheaper to deliver coal by water than by rail. He also said that the coal storage arrangements would not pollute the river, nor would the station be detrimental to any building in the vicinity. Mr. ROWAND HARKER, for Concrete Agregates, Ltd., said that his clients had received certain rights in connection with the site. The CHAIRMAN said that the erection of the station was of greater public importance, and compensation would be paid if necessary. Mr. HARKER protested, and left the committee room. In re-examination, Mr. RIDER said that the use of electricity instead of coal for domestic purposes would lead to less pollution of the atmosphere. He said that the plant of the local authorities could not be increased without the Electricity Commissioners' permission, and the Central Board could compel them to take a supply from Chiswick if it was cheaper. If the two proposed stations were constructed together, transmission systems with a minimum of mains could be arranged.

Mr. W. CASH, C.A., gave evidence regarding the finances of the Authority, and said that it was at present empowered to borrow up to £7,000,000. The London County Council was prepared to guarantee interest on a loan of £1,000,000 at least, provided the Commissioners were satisfied that the scheme was the best from a technical point of view. The Authority would have no difficulty in borrowing money; the net rate would be 5¼ per cent. Sir HOWARD FRANK, surveyor, supported the promoters' contention that the amenities of the district would not be adversely affected, and he pointed out that the station would make a great difference to the ratable value of Chiswick.

On May 26th, the Committee visited the site, and when the proceedings were resumed in the afternoon Mr. JAMES SWINBURNE, F.R.S., gave evidence that if the furnaces were properly designed there would be no emission of smoke, and the gases would not be harmful. He would not agree that the depth of water in the river would at times be insufficient for the station, and said that the discharge of condensing water into the river would not raise its temperature appreciably.

On May 27th, Mr. E. WILLIS, architect, surveyor, and engineer to the Chiswick U.D.C., gave evidence in support of the Bill, and said that his Council had passed a resolution favouring the erection of the station on the Duke's Meadows site. Steps had been taken to preserve the amenities of the district and he was confident that no nuisance would arise. The Council was convinced of the necessity for the station, and also considered the effect upon the ratable value of the district.

Sir DUNCAN WATSON, J.P., chairman of the Joint Electricity Authority and member of the Central Electricity Board, explained the powers and duties of the Authority, and gave evidence showing the necessity for the station, without which, he said, the Authority would be unable to carry on. If the station were erected the Electricity Commissioners would be able to withhold permission for the extension of small stations which at present they had to give. He quoted the number of applications for extensions which had been made by supply authorities in the area between November, 1925, and March, 1927. The aggregate amount of plant involved was 508,876 kW and sanctions representing 300,000 kW had been granted to date.

Mr. WROTTESLEY said that the witness had not included the London Power Co.'s application to erect a station at Battersea in his list; Sir Duncan replied that if the station was sanctioned the company would probably install plant at Battersea instead of Deptford. Witness further stated that not one municipality had told the Authority that it would not shut down its station to take a bulk supply. The question of shutting down plant was one for the Central Board to deal with. Asked if one municipality had agreed to take a bulk supply, Sir Duncan repeated his statement that he did not know of one authority who would refuse to do so. Replying to further questions, witness said that while the London Power Co. could demand a supply from the Joint Authority, the latter could not demand a supply from the company.

The Committee adjourned until May 30th.

On that day Mr. H. P. MCMILLAN (for the London Power Co.) said that the company's application for permission to erect a power station at Battersea was before the Electricity Commissioners, who would hold an inquiry. The company was in no way hostile to the Authority's proposals, but the Committee had to consider the electrical interests of the whole of the area. It was the concern of the company to see that nothing was done which would prejudice its application. Two different tribunals were dealing with the applications, which was a disadvantage. It was hoped that steps would be taken by which any decision of the Committee would not prejudice the company's position. He suggested that Sir John Snell might be asked to give his views.

Sir DUNCAN WATSON, in the resumption of his cross-examination by Mr. Wrottesley, said that he was satisfied that the whole of the output of the Battersea station would be taken by the ten constituent companies of the London Power Co., and that there was a need for both stations. It was not desirable to extend existing stations. He admitted that in supplying some of the central districts the extra cost of transmission from Chiswick might be sufficient to turn the scale in favour of the Battersea station.

Mr. S. L. PEARCE (engineer-in-chief to the London Power Co.) gave evidence as to the need for the two stations, pointing out that the increase of the demand for electricity in the area was more rapid than the growth of population.

The Committee adjourned until May 31st.

Washington Radio Conference.

On May 23rd, Viscount WOLMER informed Mr. Hore-Belisha that the Radio-telegraph Conference to be held at Washington would deal with certain aspects of broadcasting, and various proposals would be considered having for their object the reduction of interference between the broadcasting services and other wireless services.

Yorkshire Electric Power Bill.

This Bill has been read a second time in the House of Commons.

Special Orders Approved.

Special Orders have been approved relating to part of the rural district of Darlington, Durham, and part of the rural district of Croft, North Riding; part of the urban district of Tilbury, Essex, and the amendment of the Romford and District Electric Lighting Order, 1913; the borough of Ludlow, Salop; the burgh of Peterhead, Aberdeen; the urban district of Burnham-on-Crouch and part of the rural district of Maldon, Essex; the urban district of Axminster, the parishes of Axminster Hamlets and Chardstock, Devon, and the borough of Chard and the parish of Chard, Somerset; the parish of Dockenfield and part of the parish of Frensham, Surrey, and the parishes of Bentley, Coldrey, and Froyle, and part of the parish of Binstead, Southampton; and a Special Order authorising the Crowborough District Gas and Electricity Company to raise additional capital for electricity purposes.

Electric Railways.

On May 25th, Colonel ASHLEY informed Sir John Power that at December 31st, 1919, 821 track miles were worked, either wholly or partly by electric traction in this country, compared with 1,241 track miles at December 31st, 1926. The corresponding figure at December 31st, 1913, was 502 track miles.

General Interconnection.

On May 25th, Sir JOHN POWER asked the Minister of Transport when the Central Electricity Board expected to commence the construction of the general interconnection system.

Colonel ASHLEY said that under the provisions of the Electricity (Supply) Act, 1926, the Central Board was not in a position to commence works in any area until a scheme had been adopted for that area, and schemes could only be adopted after they had been received by the Board from the Electricity Commissioners and the statutory procedure as to publication and consideration of objections had been carried out. In those circumstances it was not yet possible to say at what date actual construction would begin.

"Beam" Wireless.

On May 26th, Viscount WOLMER informed Capt. Fraser that the beam stations for communication with South Africa were expected to be ready for the official tests in the course of the next few weeks. If the tests were successful, the stations would be taken over by the Post Office and a wireless telegraph service with South Africa would be opened. It was impossible at that stage to say whether the stations would be fully occupied with telegraph traffic, but it seemed doubtful whether a directional station was likely to be as suitable for purposes of Imperial broadcasting as a station capable of transmitting in all directions.

Imperial Broadcasting.

On May 26th, Capt. FRASER asked if the Government would make a grant to the British Broadcasting Corporation to enable it to establish and maintain a short-wave wireless transmitter to relay existing programmes to the Empire or parts of the Empire in order that such a project might be proceeded with immediately without hindering the development of the Corporation's new British scheme.

Viscount WOLMER said that the British Broadcasting Corporation had been given authority to conduct experiments in short-wave transmission, and he understood that it was its intention to carry out those experiments before putting forward any proposals for a service to distant countries. The incidence of the cost of such a service, if it should be found to be practicable, would be a matter for settlement between the Corporation and the Dominions and Colonies concerned.

Adjournment.—The House of Commons was to adjourn yesterday (Thursday) for the Whitsun recess, until June 13th.

Train Collision Report.

The report on the official inquiry into the causes of the collision between two passenger trains which occurred in February last on the L. & N.E. Railway, near Hull, has now been issued. A passenger train from Withernsea to Hull was approaching Paragon station on the incoming line when it came into head-on collision with a train from Hull to Scarborough. It is concluded that the Scarborough train was diverted to the wrong line as the result of the signalman inadvertently moving the wrong points, which were electro-pneumatically operated.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Cheap Electricity.

Mr. Mountain's plea for simpler tariffs will awaken interested support in many technical and lay breasts, but has he not considered that present-day tariffs were *evolved* from the old and apparently innocuous flat-rate? The peculiar difficulties and limitations of the electricity supply industry have always made the apportionment of charges and the assurance of an adequate and fairly-spread return a difficult problem. To fix a flat rate in the case of a particular consumer at a particular period is more or less straightforward; but to expect that rate to remain a fair one to both supply undertaking and consumer is out of the question in view of the changing conditions of industry in general, changes in the consumer's own conditions, and in the electricity supply industry itself.

The double tariff gave the consumer the opportunity of buying energy at a cheaper rate during "off-peak" periods: a choice of two flat rates. Many consumers, however, require supply only during an eight-hour day, so that they cannot avail themselves of the cheaper rate. They may be required to pay an annual "stand-by" or "minimum" charge, but why should this be regarded as an impost? Connection to a source of supply is at hand, and a supply undertaking cannot be expected to provide this gratis (and perhaps have but a dubious chance of selling energy). If (as happens) the consumer has his own generating plant, he can often quite readily and economically take kWh up to the amount of the annual or other charge; certainly he is "slow" if he does not. Where such charge can operate hardly is in the case of, say, a small colliery that is nearly worked out, and cannot bring the value of energy consumption up to the figure, much, obviously, depending on the proportion.

There are, of course, qualifying factors in tariff agreements such as a coal clause—which is not in the least mysterious, and (or so one imagines) ought to be regarded as evidence that there can be truth in economic relations as well as in advertising. We come to the two-part tariff, which has received legislative blessing—a fact which, to many minds, is by no means a guarantee of ultimate probity! The payment of a small rate per kWh on the energy consumption is, of course, quite straightforward, and its actual value may be welcomed. But the kW fixed charge is suspect. Why should it be? The consumer is, in fact, reserving for his own use plant capacity up to the value shown by the max.-demand indicator; to that extent he is a shareholder liable to the various capital and other expenses met with in generation and distribution. If this is understood, the method should appear just and straightforward. Naturally, the consumer can query the actual amount of the kW charge, but he must accept this just as he accepts the many hidden charges in a ton of pig iron or a penny tram-ride.

All the foregoing tariff schemes are not difficult of comprehension by anybody; they are quite obvious, and, moreover, an alert and inquiring consumer can check his accounts and his day-to-day electricity expenses by watching the meters.

It is when power-factor is taken into account that difficulties arise—mainly owing to its nature and implications being (as is inevitable) so non-apparent to lay, and to many engineering, minds. Should there be a sine meter, it can be made evident simply that the slower this meter advances relatively to the energy meter, the better is the p.f.; if need be, a table can enable the alert (though possibly non-technical) consumer to follow his power expenses. The two-part tariff with a kVA charge can obviously be rather more suspect than one with a kW charge—but only if the latter is vaguely understood, or if a perilous dissertation upon technical terms is undertaken. On the whole, it appears that the two-part tariff, as a tariff, is the best scheme introduced up to the present—especially when a monthly, rather than a quarterly or yearly, maximum demand is stipulated.

A great deal depends upon the attitude of the consumer to the supply authority. Belonging to one of several classes, he may be entirely trustful, or at any rate quietly acquiescent, in whatever tariff scheme is put into operation—and may take no interest in his periodic power requirements; he may be slightly dubious, but feel reassured if occasionally called on; he may be non-technical and temperamentally distrustful—a "holy terror"; he may understand electro-technical matters to a dangerously small extent—and be a plaguey nuisance; and he may really comprehend arrangements and (though naturally requiring occasional treatment) be generally satisfied, and intelligently aim at bettering his load and economic conditions.

The technical and diplomatic work in relation to the income of a supply undertaking is hardly that of a sinecure. In tariff agreements and in their actual operation the cards are put on the table, and the consumer is not always so entirely helpless as he (or others) would have one believe. This open attitude is merely in keeping with our times.

G. E. Moore.

Newcastle-on-Tyne, *March 21st*, 1927.

The Ideal Wiring System.

In view of the recent article on "The Ideal Wiring System," perhaps the enclosed samples will be of interest to you and your readers. This wiring has only been installed a matter of three years or so, in a perfectly dry house, and was only in contact with the plaster beneath the floor, *i.e.*, in the interstices between the laths. This is only one of the samples of the many breakdowns of the so-called metal-sheathed systems that have been replaced by St. Helen's C.T.S. cable. The former were perfectly bonded.

J. Dean.

Aberystwyth, *May 27th*, 1927.

[The samples sent us show the lead sheathing corroded completely through and exposing the insulating covering of the conductors at one place; in other cases, the action was in progress, but the sheathing had not been fully penetrated. It is well known that lead sheathing should not be laid in contact with plaster.—EDS. ELEC. REV.]

A Mysterious Occurrence.

The mysterious occurrence mentioned by "W.H.M." in your issue of May 27th may be due to the oil siphoning or creeping through the cables which enter the transformer.

Probably the oil had crept as far as the switch, and the act of switching-off on the Saturday started the action by dislodging some tape round the cable end. If "W.H.M." examines the backs of his switchboards he may find evidence of the outflow.

Taking the week-end as 40 hours, and the loss as 100 gallons, this is equivalent to 2½ gallons per hour, or one pint every three minutes. I find it is quite easy to obtain a flow of this amount, especially through a large l.p. cable. If the cables to the transformer are as old as the oil (10 years), there has been plenty of time for the oil to find its way down the inner layer of insulation and the small spaces between the strands.

It is impossible to diagnose the trouble exactly without seeing the transformer and the type of cable exit, but if the tank is perfectly sound, and the top of the windings is anywhere near the cable lugs so that a film of oil could pass, I should certainly suspect the cables. It will be interesting to know whether "W.H.M." finds traces of oil at the switchboard ends of the cable.

J. F. Hinsley.

Birmingham, *May 28th*, 1927.

[It is difficult to imagine that this is the correct explanation of the occurrence, but perhaps the suggestion may afford a clue to the true one.—EDS. ELEC. REV.]

Electromobiles.

As the secretary of this Association, which caters for users, manufacturers, garages and charging stations, and all other interested parties, I am frequently asked: "Why is it that electromobiles are not used to a greater extent in this country, if they possess the many undeniable advantages over other methods of town, &c., transport?"

You have frequently espoused the cause of electromobiles through the medium of your valuable periodical, which has a wide circulation among all classes, and it would be interesting to have the views of your readers through your "Correspondence" columns as to the difficulties prospective users anticipate, and those encountered by existing users.

The main obstacle appears to be the lack of a cheap and abundant supply of d.c. electrical energy for charging batteries.

I do not consider that any charging station is worthy of being registered as such unless the maximum figure of one penny per unit delivered into the battery is adhered to. There are already supplies available under this price. The first cost of the batteries and the electromobiles is another feature which presents itself to prospective users. How is this to be reduced? Can one obtain an electromobile under £200?

The Electromobile Association.

London, *May 30th*, 1927. (J. C. ELVY, *Secretary.*)

Magneto Repairs.

I shall be greatly obliged if any reader will kindly give me the following information:—

1. Names and addresses of firms which manufacture machines and the necessary equipment for winding magneto armatures.

2. If and where it is possible to obtain the necessary data for winding armatures of various makes of magnetos, and the correct method of carrying out the work.

May 28th, 1927. **Magneto.**

The "Old Cromptonians."

We have received from Mr. M. Whitgift, hon. treasurer and assistant secretary, the latest issue of the journal of the Association of "Old Cromptonians." This contains reminiscences by Messrs. G. M. Clarke and E. J. Fox, "Chelmsford Notes," and a complete list of members (186). A recent portrait of Col. Crompton is also included.

Legal.

Triumph Trust, Ltd., v. Frahm.

IN the Mayor's and City of London Court, before Judge Shewell Cooper, on May 26th, a claim was made by the Triumph Trust, Ltd., Old Broad Street, against Mr. P. H. Frahm, Littlehampton, for £5, representing five monthly instalments of £1 due under a hire-purchase agreement made in February, 1926. It was stated that the defendant purchased a wireless set from the General Radio Co., Ltd., and entered into a form of agreement with the plaintiffs, who were a financial company, to pay by instalments. In reply to the plaintiffs' requests for payment, defendant had set up a contention that £50 was due to him from the General Radio Co., Ltd., on account of commission on sales of radio sets in and around Littlehampton. Plaintiffs were not concerned with that matter as they had merely taken the part of discounters in the transaction. The defendant set up a counter-claim for £50, and said that after replying to an advertisement by the General Radio Co., an arrangement was come to whereby he was appointed district agent for an area in the neighbourhood of Littlehampton, and was to receive a commission of 25s. on every wireless receiving set installed by the General Radio Co. in that district, whether as a result of his introduction or not. It was necessary that he should have a set for demonstration purposes, and he paid £5 on account, and signed the agreement now produced by the plaintiffs. He believed that about 50 receiving sets had been sold in his district. Judge Shewell Cooper said that his remedy was to proceed against the General Radio Co., Ltd., and not the plaintiffs, and gave judgment for the plaintiffs on the claim and counter-claim, with costs.

The Dublin and Lucan Electric Railway Co.

IN the High Court, Dublin, on May 23rd, application was made for the confirmation of the sale of the undertaking of the Dublin and Lucan Electric Railway Co. (in liquidation) to the Dublin United Tramways Co., Ltd., for the sum of £12,500 in pursuance of an agreement between the two companies. The official liquidator (Mr. D. McDowall Grosart) also asked for an inquiry to ascertain the amount of prior charges. Counsel for the Dublin Tramways Co. said that there would be a claim against the company for electricity supplied. The Judge ordered the Dublin Tramways Co. to lodge the sum of £12,000 with the liquidator and directed the inquiry to be made.

British Thomson-Houston Co., Ltd., v. Star Electric Lamp Co.

MR. JUSTICE CLAUSON, in the Chancery Division on May 27th, in default of defence, entered judgment for the British Thomson-Houston Co., Ltd., in an action against the Star Electric Lamp Co., of Newcastle, to restrain defendants from selling or dealing in articles made in infringement of the plaintiffs' letters patent 10918 of 1913, relating to gasfilled electric lamps.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

27,430. "Induction electric furnaces." Ajax Electrothermic Corporation. February 14th, 1925. (247,519.)

27,518. "Automatic telephone system." H. Baron (F. Aldendorff). November 2nd, 1925. (270,055.)

30,476. "Asymmetric electric couples for rectifying alternating current and like purposes." S. Ruben. December 2nd, 1925. (270,302.)

1926.

625. "Electric inductance apparatus." Siemens Bros. & Co., Ltd., and C. R. Riber. January 8th, 1926. (270,370.)

705. "Sound-reproducing apparatus." British Thomson-Houston Co., Ltd., A. P. Young and J. Hutt. January 9th, 1926. (270,371.)

3,010. "Electrical measuring instruments." G. Wall, W. Trelford, R. P. Cartwright, A. R. Dunton and Metropolitan-Vickers Electrical Co., Ltd. February 2nd, 1926. (270,377.)

3,139. "Switching arrangements for electrical machines." Siemens Bros. and Co., Ltd., and V. Turner. February 3rd, 1926. (270,380.)

3,145. "Electric couplings for valves, coils, and the like of wireless apparatus." Dr. M. Libermann. February 11th, 1925. (257,549.)

3,228. "Alternating-current dynamo-electric machines." H. De Pistoye. February 4th, 1926. (270,384.)

3,240. "Trunking system of radio distribution." E. F. Colladay. February 14th, 1925. (247,550.)

3,242. "Cap fittings for electric lamps." W. Dawson. February 4th, 1926. (270,385.)

3,247. "Sound-reproducing apparatus." British Thomson-Houston Co., Ltd. October 28th, 1925. (260,537.)

3,276. "Headlights for automobiles and the like." A. L. Strange. February 4th, 1926. (270,388.)

3,419. "Thermionic valves or holders for thermionic valves." F. J. Willmott. February 6th, 1926. (Cognate application 7,347/26.) (270,400.)

3,435. "Radio-receiving apparatus." M. Wallace. April 27th, 1925. (251,240.)

3,529. "Protective arrangements for alternating current electric circuits." A. Reyrolle & Co., Ltd., and R. W. Biles. February 8th, 1926. (270,410.)

3,546. "Inductance coils particularly for use in connection with radio apparatus." Igranic Electric Co., Ltd., and W. K. Alford. February 8th, 1926. (270,411.)

3,568. "Electric apparatus for boiling and like purposes." W. Guy-Pell and W. West. February 8th, 1926. (270,414.)

3,585. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. February 11th, 1925. (247,555.)

3,689. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. February 9th, 1926. (270,419.)

3,690. "High-potential insulated conductors." British Thomson-Houston Co., Ltd., and H. C. Heath. February 9th, 1926. (270,420.)

3,691. "Devices for emitting and receiving sound." N. W. McLachlan. February 9th, 1926. (270,421.)

3,846. "Electric lighting, heating, and ventilating of railway vehicles." J. Stone & Co., Ltd., and A. H. Darker. February 10th, 1926. (270,426.)

4,424. "Lighting apparatus." R. I. Atherton. February 16th, 1926. (270,434.)

4,856. "Dynamo-electric machines." J. S. Peck, J. A. Kuyser, and Metropolitan-Vickers Electrical Co., Ltd. February 19th, 1926. (Cognate application 8,654/1926.) (270,438.)

5,280. "Electrical condensers." V. Magyar. February 24th, 1926. (270,445.)

5,610. "Electrical machines with commutators." General Electric Co., Ltd., and A. E. Angold. February 27th, 1926. (270,447.)

5,912. "Audible signalling devices." A. E. White (Sparks-Withington Co.). March 2nd, 1926. (270,449.)

6,086. "Electric switching devices." F. Davies and L. D. MacGregor. March 4th, 1926. (270,451.)

7,030. "Circuit interrupters." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. March 13th, 1926. (270,456.)

7,278. "Sound-amplifying devices." D. F. Walker. March 16th, 1926. (Addition to 225,250.) (270,457.)

7,972. "Sectional electrical bus-bars." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. March 23rd, 1926. (270,462.)

9,866. "Loaded four-wire conductors." Siemens & Halske Akt.-Ges. May 8th, 1925. (251,957.)

11,581. "High-tensionless wireless receiver." W. W. Sparey. May 29th, 1926. (270,486.)

11,890. "Circuit arrangements for generating electric oscillations." H. Wade (Naamloose Vennootschap Philips' Gloeilampenfabrieken). May 6th, 1926. (270,488.)

14,263. "Switches for electric flashlight apparatus." A. Woosnam (Svenska Aktiebolaget Gasaccumulator). June 7th, 1926. (270,507.)

14,304. "Construction of dynamo-electric machinery." Harland Engineering Co., Ltd., and A. S. Murdoch. June 7th, 1926. (270,508.)

15,073. "Insulating, protecting, and indicating device for dry cells and the like." M. Sinsinovici. May 8th, 1926. (270,511.)

15,687. "Method of preventing evaporation and oxidation of heated electrolytes." Dr. A. L. Mond (F. Warlimont). June 22nd, 1926. (270,514.)

15,851. "Searchlights." H. Eckschlager. June 24th, 1926. (270,516.)

17,750. "Imitation fires." Automatic Telephone Manufacturing Co., Ltd., and C. H. Archer. July 15th, 1926. (270,522.)

19,432. "Ceiling rose or like electric fitting." E. Reed. August 6th, 1926. (270,530.)

19,752. "Thermionic valve circuits." Soc. Française Radio Electrique. August 10th, 1925. (256,653.)

20,111. "Wireless signalling." C. P. Allinson. August 14th, 1926. (270,531.)

20,305. "Electric insulation board and method of making the same." D. M. Sutherland, Junr. August 17th, 1926. (270,535.)

20,406. "Methods of reducing noise in telephone circuits." Standard Telephones & Cables, Ltd. October 7th, 1925. (259,546.)

20,536. "Vacuum tubes." Dr. S. Loewe. August 25th, 1925. (257,604.)

20,751. "Thermally-operated switches or circuit breakers for protecting electric circuits." Calor Elektrizitäts-Akt.-Ges. and O. Dreyer. August 23rd, 1926. (270,540.)

21,584. "Guide roller for the cables of electric laundry irons." A. Machler and W. Werner. September 1st, 1926. (270,544.)

23,063. "Galvanic mass production." Langbein-Pfanhauser-Werke Akt.-Ges. February 20th, 1926. (266,285.)

26,547. "Electrical protective systems." Metropolitan-Vickers Electrical Co., Ltd. January 16th, 1926. (264,454.)

28,048. "Primary voltaic cells." Compagnie Française pour l'Exploitation des Procédes Thomson Houston. November 12th, 1925. (261,371.)

28,408. "Reflecting devices for advertising signs, signals, and the like." A. H. Brackensey and Franco-British Electrical Co., Ltd. November 11th, 1926. (270,571.)

29,217. "Carriers for accumulators and the like." K. J. Horstmann. November 19th, 1926. (270,575.)

31,735. "Electric cut-outs and the like." W. T. Henley's Telegraph Works Co., Ltd., W. H. Nichols, and E. Moor. December 14th, 1926. (270,594.)

1927.

217. "Electrode carriers for electric furnaces." Akt.-Ges. Brown, Boveri et Cie. January 7th, 1926. (264,157.)

517. "Electric high-tension switches." Metropolitan-Vickers Electrical Co., Ltd. January 14th, 1926. (264,484.)

1,745. "Wireless telegraphy and telephony receiving outfit for mounting on motor vehicles." G. Gailly and C. Les Enfants. October 23rd, 1926. (270,608.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from May 25th :—

Gestetner. No. 470,048. Class 6. Electrically-driven duplicating machines and parts thereof.—D. Gestetner, Ltd., Fawley Road, Tottenham Hale, N.17.

V.D.E. (lettering and design). No. 460,704. Class 7. Machinery of all kinds No. 460,705. Class 8. Philosophical and scientific instruments and apparatus for useful purposes. No. 460,707. Class 11. Instruments, apparatus and contrivances for surgical or curative purposes. No. 460,708. Class 6. Metal goods.—Verband Deutscher Elektrotechniker, Berlin. (British representatives: Edward Evans & Co., 27, Chancery Lane, W.C.2.)

Gecovalve. No. 476,214. Class 8. Valves for use in radio-telephony and telegraphy.—General Electric Co., Ltd.

Elima. No. 480,025. All goods in Class 8.—A. Hartley, 37, Standish Street, Burnley.

Zendix. No. 479,101. Class 11. Electric appliances for surgical or curative use, &c.—R. A. Shortland, trading as Shortland Bros., 10, New Brown Street, Manchester.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERYSTWYTH.—Casino Hotel, Marine Terrace (£80,000); T. Huntingdon & Co., builders, London.

ARMTHORPE.—Business stores, for the Doncaster Co-operative Society; T. H. Johnson, architect, 20, Priory Place, Doncaster.

AUSTRALIA (ADELAIDE).—Improvements, Memorial Hospital; Board of Trustees. Theatre and shops, Rundle Street; Hoyt's Theatres, Ltd. Additions, Film Exchange; Famous Lasky Film Service, Ltd.

AYLESBURY.—County offices, for Bucks. C.C.; county architect.

AYR.—Picture theatre, tea room, and offices, for Scottish Cinema and Variety Theatres, Ltd. (£10,000); the secretary.

AYRSHIRE.—R.C. School (£8,000), at Irvine; clerk, Education Authority, Ayr.

BASINGSTOKE.—Nurses' home, Park Prewett Mental Hospital, for Hants. C.C.; Gutteridge & Gutteridge, architects, 9, Portland Street, Southampton.

BELPER.—Sewage disposal works; surveyor to R.D.C.

BIRMINGHAM.—Picture house, Soho Road and Booth Street, Handsworth, for H. A. Barber, estate agent, 5 and 6, Grosvenor Chambers, Broad Street Corner.

BLACKPOOL.—Houses (50), for the T.C.; H. Hibbert & Sons, builders, Barnsley.

BOLTON.—School, Castle Hill, Tonge Moor; Director of Education.

BOURNEMOUTH.—Church, Wootton Gardens, with electric lighting and heating work, for the Strict Baptist trustees; the secretary.

BOURNEMOUTH.—Wesleyan Church, Winton (£15,000); George Shears & Son, builders.

BUCKINGHAM.—Milk factory, for the London Co-operative Society; T. J. Walker, builder, Winslow.

BURSLEM.—Drill hall, for Staffs. Territorial Army Association; the secretary, Stafford.

CHESHIRE.—Mental hospital accommodation, Upton and Parkside; Committees of County Council.

CHORLEY.—Roman Catholic Central School; Catholic trustees.

CHRISTCHURCH.—Extension of the casual wards, for the Bournemouth and Christchurch Board of Guardians; P. C. Ford, clerk to the Board.

CLATTERBRIDGE.—Extensions, Isolation Hospital; Wirral Joint Hospital Board.

COATBRIDGE.—Sewage works; Corporation engineer.

COVENTRY.—Housing scheme (74), Gulson Road and Harnall Lane; E. H. Ford, city engineer, Council House.

CREWE.—Secondary school extensions, for Cheshire E.C.; F. A. Browne, county architect, Newgate Street, Chester.

CROYDON.—Cinema, Woodside Grange, Addiscombe, with electrical work (£28,500); W. L. Griffiths, architect, London.

DEAL.—Band pavilion (£9,000), for the T.C.; borough surveyor.

DENBIGHSHIRE.—Mental deficiency home (£120,000), for the C.C.; the clerk, Wrexham.

DOUGLAS (ISLE OF MAN).—Housing scheme (66), Olympia Estate, for the T.C.; J. E. Teare, architect, 46, Athol Street.

EDINBURGH.—352 houses at Gorgie Road, for Corporation; city architect.

EXHALL ASH.—Elementary school (£17,500); Warwickshire Education Committee.

HAMPSHIRE.—Equipment of small holdings (£45,000); County Agricultural Committee.

HARLINGTON (HOUNSLOW).—School (£16,500), for Middlesex E.C.; Sir B. S. Gott, secretary, Westminster Guildhall.

HARROW WEALD.—Secondary school, for Middlesex E.C.; Sir B. S. Gott, secretary, Westminster Guildhall.

HECKMONDWIKE.—Co-operative stores, Six Lane Ends; Stead & Walshaw, architects.

HERNE BAY.—Joint Hospital; Herne Bay and Whitstable U.D.C.'s. Municipal offices, for U.D.C.; Prof. A. E. Richardson, assessor.

HIGH WYCOMBE.—Factory, Desborough Park Road, for Lidgley Bros. Factory, Bellfield Approach, for C. H. and S. Keen. Factory extensions, Oxford Road, for Marechal Ruchon & Co., and Totteridge Avenue, for E. Turner.

INDIA (BOMBAY).—Hospital at Mahim; Sir Leslie Wilson's Hospital Fund and Corporation.

IRISH FREE STATE (LIMERICK).—New dock for the Harbour Commissioners; T. F. O'Sullivan, Harbour engineer.

KETTERING.—Hospital extensions (£13,000), for the Joint Hospital Board; the clerk.

LONDON (HACKNEY, E.).—Additions, chocolate factory, Farleigh Road; W. Hennessey & Sons.

(E.C.).—Buildings, 50-51, Little Surrey Street; Premier Press, Ltd.

(HIGHGATE, N.).—Extensions, Highgate School, Southwood Lane; A. E. Munby, 9, Old Square, Lincoln's Inn.

(HOLBORN, W.C.).—Telephone Exchange, Grays Inn Road; Office of Works.

(BATTERSEA, S.W.).—Conversion of Southlands College into elementary school; L.C.C. Education Committee.

(PUTNEY, S.W.).—Additions, Royston Works, Upper Richmond Road; Simmons Bros.

(REGENTS PARK, S.W.).—New wing, Bedford College for Women; Principal.

(STREATHAM, S.W.).—Shops, restaurant and flats, 68-70, Streatham Hill; Rice & Son.

(ACTON, W.).—Technical institute and school (£50,263), for Middlesex E.C.; Sir B. S. Gott, secretary, Westminster Guildhall.

MARCH.—County hall extension, Isle of Ely; county surveyor.

MILFORD HAVEN.—Central school; Pembroke Education Committee. Sanitary block, County School; Pembrokeshire Education Committee.

NEWCASTLE.—100 houses, High Heaton, for Corporation; J. Jacob Paget. Baths, Armstrong Road (£42,500); city engineer.

NORTHAMPTON.—Extensions, town and county school; Education Committee. Additional 84 houses, Weedon Road Estate, for the T.C.; A. Fidler, borough engineer.

ONGAR (ESSEX).—Housing scheme (32), for the R.D.C.; P. R. B. Pearce, surveyor.

PENKULL (STAFFS.).—Development of Garden Village for Stoke-on-Trent Tenants, Ltd.; W. Campbell & Sons, architects.

PENRITH.—Bottling stores, Roper Street; Glassons Brews, Ltd.

PENZANCE.—Scheme for 190 houses, York House Estate; borough engineer.

PERTH.—Stores and workshops for T. Love & Sons, cabinetmakers, St. John's Place; the manager. Repairing factory for Messrs. Norwells' Perth Footwear, Ltd., 47, High Street; the manager.

PLYMOUTH.—United Methodist Church; trustees. Maternity wards, Alexandra Homes, St. Michael's Terrace; Committee.

PORTSLADE.—Electricity for lighting and power; Petersfield Laundry.

ROCHDALE.—Super cinema and café, Wet Rake, Drake Street (£30,000); for Roach Dale Amusements, Ltd.

SCOTLAND.—1,000 steel houses, for various authorities in middle and west Scotland; Second Scottish National Housing Company (Housing Trust), Ltd.

SEAHAM HARBOUR.—72 houses, Carr House Estate; U.D.C. surveyor.

SHIPSTON.—Electric lighting, Police Station and Court; Worcestershire Standing Joint Committee.

SKEGBY.—Elementary school (£16,500); Notts. Education Committee.

SOUTHGATE.—56 houses, Barrow Close; Church Army Housing, Ltd.

STIRLING.—Picture house at 48, Queen Street; Messrs. Menzies Bros., 15, Orchard Place.

STOKE-ON-TRENT.—150 houses for Michelin Tyre Co., Ltd.; city architect.

STOURBRIDGE.—Girls' secondary school (£26,424), for Worcestershire E.C.; A. H. Guest, Ltd., builders, Coalbournbrook Wharf. Extensions to Grammar School (£7,500), for the Governors; the clerk.

STRATFORD-ON-AVON.—Extensions, Grammar School (£20,000); Governors.

THRAPSTON.—Secondary school for girls; Northants Education Committee.

TORQUAY.—Wesleyan Church, Union Street (£23,160); R. F. Yeo & Son, builders. Telephone exchange, Westhill; Office of Works.

TYNEMOUTH.—Electricity supply, new premises in Mariners Lane; British Petroleum Co., Ltd. 56 tenements, Percy Street; Corporation housing architect.

WALLASEY.—Joint mental hospital; Corporations at Wallasey, Birkenhead, and Chester.

WARWICK.—Extensions, county offices, Warwickshire; county architect.

WELSHPOOL.—County offices (£10,000), for Montgomeryshire C.C.; C. S. Thornley, architect, Liverpool.